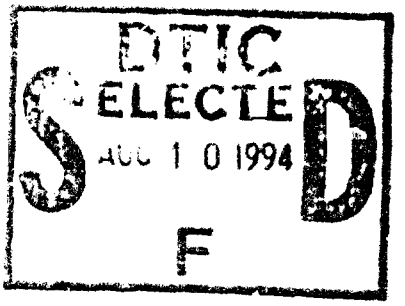
Logistics Management Institute

U.S. Army Corps of Engineers Manpower Information System:

An Integrated Approach to Manpower Management



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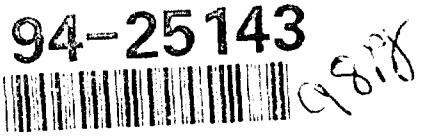

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April 1994

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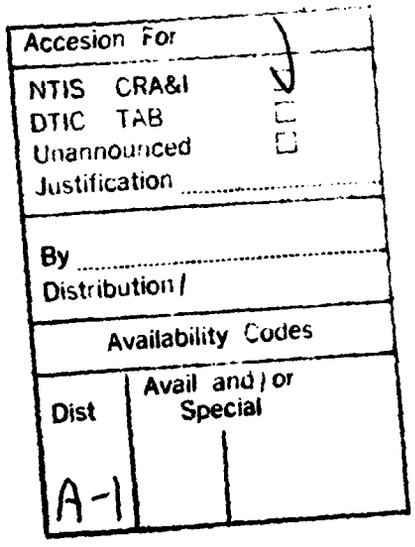

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Prepared pursuant to Department of Defense Contract DACW31-90-D-0076. The views expressed here are those of the Logistics Management Institute at the time of issue but not necessarily those of the U.S. Army Corps of Engineers.

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U.S. Army Corps of Engineers Manpower Information System: An Integrated Approach to Manpower Management

Executive Summary

The U.S. Army Corps of Engineers (USACE) provides engineering and construction management services for both military and civil works programs. In FY93, the cost of those programs exceeded $10 billion and their implementation required more than a 40,000-person work force. Managing this work force is an important part of USACE program execution. Those workforce management processes are periodically reviewed to ensure that USACE is getting the most for its manpower dollar.

In early 1992, USACE held the Corps of Engineers Manpower Management Software Review Workshop (the "Software Review Workshop") at Fort Belvoir, Virginia. The key purpose of that Software Review Workshop was to discuss the current use of two separate sets of Class VI[1] system software to develop, defend, and distribute manpower allocations within USACE; namely, the Corps of Engineers Resource and Military Manpower System and the Civilian Force Configuration and Management. A related issue was to explore the USACE costs, benefits, and barriers to implementing a single Class VI system software package for both the military and civil works programs.

During the final session of the Software Review Workshop, the participants reviewed the working papers and developed the recommendation that . . .

> The Corps should proceed to the next step in the systems analysis process and begin developing conceptual design plans for the development of a single manpower model for civil works and military programs.[2]

We build upon that recommendation.

We recommend the development of a system that uses the current communication capabilities of the USACE wide-area network and meets the following key requirements: First, USACE's leaders expressed the need for a system that is easy to learn and use, easy to implement in the field, and can be used in the field as a planning and management tool. Second, the system should be able to estimate the manpower required to execute USACE's programs, support the allocation process, provide information in useful ways, track utilization information,

[1] A Class III system is defined in AR 25-3. It is a system whose total program costs are less than $2.5 million, that can be reviewed and approved by the major command (MACOM), and that will be managed by the MACOM's functional proponent.

[2] *Manpower Management Software Review Workshop Draft Report* dated 21 April 1992, Fort Belvoir., VA.

support "what if" analyses, and draw upon various sources of data. Third, the system should provide a unified, standardized, relational data base from which consistent standard and ad hoc joint reports can be generated from the same essential information. Finally, USACE must gain the functional capabilities – such as decision support, executive information retrieval, and geographic information displays – that existing manpower systems lack.

We believe a unique opportunity exists to develop an integrated Class VI system for managing USACE manpower in a way that incorporates appropriate technologies and provides USACE managers with a consolidated view of their use of human resources. That integration will require a change in the manpower management process at all levels.

A process is needed that provides adequate representation by all organizations involved, yet has some centralized direction. The development of that process is perhaps as important as the development of the software itself, and it should be done in parallel with the system's development.

If this opportunity is missed, it is likely that the key participants in manpower issues – the Civil Works Directorate, the Military Programs Directorate, and the Resource Management Directorate – will pursue independent system upgrades that will not be cost-effective and that, in all likelihood, will perpetuate the inconsistencies that exist today.

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CHAPTER 1

Introduction

BACKGROUND

The U.S. Army Corps of Engineers (USACE) provides engineering and construction management services for both military and civil works programs. In FY93, the cost of those programs exceeded $10 billion and their implementation required more than a 40,000-person work force. Managing this work force is an important part of USACE program execution. Those workforce management processes are periodically reviewed to ensure that USACE is getting the most for its manpower dollar.

In early 1992, USACE held the Corps of Engineers Manpower Management Software Review Workshop (the "Software Review Workshop") at Fort Belvoir, Virginia. The key purpose of that workshop was to discuss the current use of two separate sets of Class VI system[1] software to develop, defend, and distribute manpower allocations within the Corps; namely, Corps of Engineers Resource and Military Manpower System (CERAMMS) and Civilian Force Configuration and Management (FORCON). A related issue was to explore the costs, benefits, and barriers to implementing a single Class VI system software package for both the military and civil works programs.

During the first part of the Software Review Workshop, the program managers for each software product provided an overview of their respective software products. That overview addressed system inputs, outputs, processes, manpower management decision-making processes, and the strengths and weaknesses of each software package. Each software package was demonstrated on a personal computer – showing actual screen displays of inputs, processes, and outputs. At the end of the overview, a question and answer period was conducted to expand on issues raised during the overview presentations.

The second part of the workshop focused on the feasibility of designing, building, and implementing a single, integrated system to accomplish the functions of both CERAMMS and FORCON. The participants developed draft working papers that defined the primary benefits, costs, and potential barriers to establishing an integrated system. Those working papers included a discussion of the kinds of enhancements and improvements an integrated system could include relative to the functions provided by the current systems.

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[1] A Class VI system is defined in AR 25-3. It is a system whose total program costs are less than $2.5 million, that can be reviewed and approved by the Major Command (MACOM), and that will be managed by the MACOM's functional proponent.

During the final session of the workshop, the participants reviewed the working papers and developed the recommendation that

> The Corps should proceed to the next step in the systems analysis process and begin developing conceptual design plans for the development of a single manpower model for civil works and military programs. [2]

The purpose of this document is to expand upon the findings and recommendations of the workshop, develop and discuss alternatives, and make recommendations on future USACE manpower management systems.

CORPORATE INFORMATION MANAGEMENT

When planning the future direction of USACE manpower management software, it is useful to review the tenets of the Corporate Information Management (CIM) program. Although the types of systems under consideration in this document are not large-scale, "major" systems, the basic principles of information management espoused by CIM are pertinent and should be considered when developing the next generation of manpower management software.

The CIM initiative was established by the Department of Defense to provide senior leaders with the policies and mechanisms they need to achieve the goal of smooth and rapid transition into the "Information Age." The CIM concept identifies the principles and practices proven in industry and government during the past decade and applies them to the defense challenge. The following are applicable CIM principles:

- Standardize processes and practices when this does not impair operations.
- Apply functional process improvement methods and tools successfully used in industry to manage continuous cycles of improvement to cost, quality, timeliness, and productivity.
- Integrate processes, data, and information systems to achieve greater interoperability, flexibility, efficiency, and effectiveness within and across missions and functions.
- Provide central guidance and direction of information systems development and services, using common architectures, standard data elements, and common methods and tools. An integrated, secure, reliable, and efficient defense information infrastructure will provide shared, cost-effective information services to the entire DoD.

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[2] *Manpower Management Software Review Workshop* Draft Report dated 21 April 1992, Fort Belvoir, Va.

PROPOSED AND ONGOING USACE MANAGEMENT INITIATIVES

A number of management initiatives are now being proposed, considered, and (in some cases) implemented. Each of these initiatives might have a significant impact on manpower management. Some of the recommendations are likely to be implemented, while others are being met by resistance from within and outside USACE. Any new manpower management system should recognize these initiatives and be adaptable to those that are implemented. The following subsections describe the initiatives that, if implemented, will significantly change current manpower forecasting and methods.

Headquarters

USACE Headquarters is being reorganized concurrently with the field structure and processes. Numerous actions will be implemented to remove redundancy, improve efficiency, and reduce costs at headquarters. Headquarters will retain the functions of program guidance, resource allocation, corporate leadership, and coordination with other major commands and Federal agencies, but it will shed other functions that it has historically performed.

Division Offices

It was proposed that the number of divisions be reduced to six as shown in Figure 1-1. Technical and policy review may also be removed from the division offices.

District Offices

A proposed reorganization plan calls for the retention of all current CONUS district offices, while adding one new district headquarters in the Boston area. Planning and engineering, operating in all districts, will be consolidated in 15 technical centers that will be collocated with 15 districts. Military design and construction will be consolidated at 10 districts collocated with technical centers to provide more efficient service.

Other Significant Changes

All districts have, or will have, program and project management (PPM), (which did not exist when CERAMMS was originally developed), operations, regulatory, construction, and other necessary support services. A rather significant change is that project managers will be allowed to select the technical centers that can best satisfy customer requirements. One administrative center will

Figure 1-1.
A Proposed Restructuring of U.S. Army Corps of Engineers Divisions and Districts

be established for each of the divisions. Division administrative centers will include elements from information management, management analysis, human resources, and internal audit. In addition, USACE will centralize into a single finance and accounting (F&A) center to process all F&A documentation.

Overview of Existing Manpower Management Systems

The USACE has two primary systems for managing manpower. CERAMMS is used to forecast and allocate manpower requirements for the Military Programs Directorate, while FORCON accomplishes those functions for the Civil Works Directorate. The following subsections provide brief overviews of both systems. More detailed information is provided in the appendices.

Corps of Engineers Resource and Military Manpower System

The multiple information requirements of USACE and its desire to be able to run the model on a microcomputer led to the development of CERAMMS as a series of interrelated modules. The model addresses the two primary USACE management needs – forecasting requirements and allocating resources. The management of manpower resources is intimately related to the management of funds for planning and design (P&D) and construction supervision and administration (S&A). The two forecasting modules and the S&A and P&D modules quantify the requirements for manpower and funding, and the allocation module apportions the available manpower resources to USACE divisions. Consistency among the modules is maintained through the use of common input files, which ensures that the same assumptions and policies that drive manpower requirements are used to determine P&D and S&A funding requirements.

Civilian Force Configuration and Management

The Civil Works Directorate, USACE, uses FORCON as a tool to develop its civil works personnel resource requirements and to determine full-time equivalent (FTE) workyear allocations. The FORCON model provides the means by which districts, divisions, and other field operating activities (FOA) project their workyear requirements for the civil works mission. The FORCON model provides a 5-year view of FOA manpower utilization and requirements from past year (PY) through budget year (BY) plus 2 years. For the current year (CY), FORCON represents how a district or other FOA plans to execute its program. In the BY, FORCON represents a district or other FOA preferred plan of how funds and manpower will be allocated to fully execute the budget.

FORCON uses an algorithm to relate program workload to manpower requirements. Computed averages are developed that, for a given project or

program funding level, can predict manpower requirement trends by function for BY+1 and BY+2.

REPORT ORGANIZATION

The remainder of this report presents the findings, conclusions, and recommendations of our study. Chapter 2 summarizes the functional requirements needed from a consolidated model. Chapter 3 analyzes the available technologies. Chapter 4 describes the recommended system. Appendices A and B provide more detailed descriptions of CERAMMS and FORCON, respectively. Appendix C presents a plan for systems development and implementation.

CHAPTER 2

Enhancement of USACE Manpower Modeling Systems

This chapter summarizes the improvements and enhancements required for the USACE manpower modeling systems to effectively meet the Corps' management requirements. First, we compare two new system design strategies and the status quo (i.e., no-change alternative). We discuss the technology options available to meet the system requirements presented in Chapter 3. Then we discuss the recommended system as the preferred design for the future manpower system, along with a more detailed discussion of the system's logical and physical design in Chapter 4.

PROPOSED IMPROVEMENTS AND ENHANCEMENTS FOR CURRENT USACE MANPOWER ALLOCATION SYSTEMS

An effective manpower management system should address five functions: (1) it should be able to estimate the manpower required to execute USACE's programs; (2) it should be able to support the allocation process; (3) it should be able to provide program information in useful ways; (4) it should be able to track utilization information; and (5) it should be able to support "what if" analyses. We identified the desired systems improvements and enhancements needed to support these five functions based on the results of the 1992 Software Review Workshop. Additional information was gathered from later meetings and interviews with Headquarters, USACE (HQUSACE) managers for both the CERAMMS and the FORCON systems. Seven primary areas of improvement were identified at the Software Review Workshop as requirements for managing manpower.

- *Improve user-friendliness.* Both systems must be simplified and made more user-friendly so that managers at the field offices fully understand the systems and their capabilities. Some people feel that the display screens and user interface can be improved by providing a simplified user-friendly environment for managers without requiring extensive learning or computer skills.

- *Provide the ability to interface with other USACE management information systems.* The manpower systems must be integrated with existing and planned USACE management information systems to provide more comprehensive information relevant to manpower planning. The ability of the manpower systems to access data from the USACE finance and

accounting system, project management system, and personnel systems would significantly enhance the manpower allocation process.

- *Provide a consolidated view of the total USACE manpower requirements.* Under the current stand-alone systems, information on military and civil works manpower is stored and displayed separately and cannot be easily consolidated in any common format or set of information. The HQUSACE requires a consistent format and set of informative reports to view its total manpower requirements.

- *Account for all USACE manpower requirements within one system.* USACE manpower is accounted for in a number of independent systems. Effective management of USACE manpower requires that all manpower be accounted for in one system. Staffing associated with laboratories, real estate, and environmental operations should be included in the same system that addresses Military and Civil Works manpower.

- *Reduce system operations and maintenance costs by eliminating duplication.* The operations and maintenance of the current stand-alone systems is inefficient because they require some degree of duplication by system administrators. Greater efficiency can be achieved by eliminating the duplication of common system functions and code, thereby reducing the manpower and resources required for systems operations and maintenance.

- *Lessen field input requirements.* Some aspects of the current system are input-intensive. They require significant amounts of time and effort to provide the needed data. Much of these data exist in other USACE systems, need not be manually entered, and should be accessed automatically when needed.

- *Improve the accuracy of forecasts.* Manpower forecasting is a difficult task; however, the methods for producing such forecasts should be reviewed and modified to provide forecasts that are as accurate as possible.

ALTERNATIVE DESIGN STRATEGIES FOR THE FUTURE MANPOWER MANAGEMENT SYSTEM

In the next step of the systems analysis process, we define three distinct design strategies for developing the future USACE manpower models. Those alternative strategies are as follows:

- **Strategy 1.** Develop enhanced versions of both the FORCON and CERAMMS manpower systems.

- **Strategy 2.** Develop a single, integrated system to provide USACE manpower management information.

- **Strategy 3.** Continue with the status quo systems with no additional improvements or enhancements.

Each of these strategies is discussed in some detail below.

Strategy 1: Enhance Both FORCON and CERAMMS

Under this strategy, both FORCON and CERAMMS would continue to be operated as stand-alone information systems using separate application software. Any elimination of system deficiencies and the addition of system improvements and enhancements would be incorporated into the current system design.

ADVANTAGES

- Some enhancements could be accomplished in phases and added to the current models without major systems redesign.

- The personnel required to implement the systems enhancements are already in place and familiar with the current systems.

- Direct interface with other USACE management information systems will remain but will be limited.

DISADVANTAGES

- Some enhancements cannot easily be added to the existing systems without major systems redesign.

- The current software limits the use of certain user-friendly features, such as on-line help screens, graphics, and push-button functions.

Strategy 2: An Integrated System for Manpower Forecasting

Under this strategy, USACE would develop a single, integrated information system to provide USACE manpower information. Both FORCON and CERAMMS would be redesigned to use common application software. The redesign would allow direct interface with other current and future USACE information systems and would incorporate the required system improvements and enhancements.

ADVANTAGES

- The new system design offers the greatest flexibility to develop an easy-to-use system.
- Duplication of systems operations and maintenance costs will be eliminated.
- The system can be designed to provide direct interface with other USACE information systems.
- Manpower information and reports can be presented to managers in a consistent format.
- A single, consolidated, relational data base can be constructed that contains military, civil works, and utilization data.

DISADVANTAGES

The costs for developing and implementing an integrated system are higher than the two other strategies.

Strategy 3: Status Quo — No Enhancements

Under this strategy, both FORCON and CERAMMS would remain as stand-alone systems and would not be enhanced to meet future requirements. We assume that the only required upgrades would be regular operations and data updates.

ADVANTAGES

- This is the least-cost development strategy in the short run.
- Implementing this strategy causes the least amount of disruption to the current management reporting system.

DISADVANTAGES

- User friendliness will not be improved.
- Direct interface with other USACE information systems will remain cumbersome.

- Other desired improvements and enhancements will not be accomplished.
- System operations and maintenance costs will remain high because of duplication of effort.

SUMMARY

Although variants and combinations are possible, the three strategies discussed in this chapter constitute the most realistic courses of action. Strategy 2, an integrated system, would require a significant change in the current USACE approach to managing manpower. This is particularly true at the Headquarters and Division levels where manpower has traditionally been managed within organizational stovepipes. The impact of these changes is discussed in more detail in Chapter 4. In the next chapter, we assume that one of these three strategies will be implemented and examine the technologies that could be employed for that implementation.

CHAPTER 3

Technology Options for the Proposed System

This chapter assesses the alternative technologies for designing the future manpower management system that we will refer to as the Corps of Engineers Manpower Information System (CEMIS). Our assessment is limited to those technologies that are appropriate for the three strategies discussed in Chapter 2. In this assessment, we address the following three major components of the proposed CEMIS:

- data base management systems (DBMSs),
- executive information systems (EISs), and
- analysis tools (i.e., Decision Support Systems).

DATA BASE MANAGEMENT SYSTEMS

For the purpose of this evaluation, we focus on two types of data base management systems: (1) workstation-based DBMSs, and (2) DBMSs with structured query language (SQL) capabilities.

Workstation-Based DBMSs

Workstation-based DBMSs operate on stand-alone desktop microcomputers. We examined the following six most popular commercial off-the-shelf (COTS) PC/workstation-based DBMS packages:

1. Access v.1.1,
2. dBASE IV v.1.5,
3. FoxPro for Windows v.2.5,
4. ORACLE,
5. Paradox v.4.0, and
6. R:Base v.3.1c.

Evaluation Criteria and Features Evaluated

We assessed the DBMS software using the following nine evaluation criteria: (1) source code portability, (2) data portability, (3) performance, (4) query by example (QBE) facility, (5) unlimited distribution, (6) ease of use, (7) DOS supportability, (8) convertibility, and (9) software longevity. Unlimited distribution refers to whether a package offers a run-time version of custom applications. Convertibility refers to how well a package will be able to smoothly convert existing code and data. Software longevity refers to the long-term prospects of software support from the software's manufacturer.

We focused on three primary system features: data storage and management, user interfaces, and application development.

Data Storage and Management

Essentially, three methods can be used for the physical storage and manipulation of data in the PC industry: centralized data base storage (best represented by R:Base), separate file storage (best represented by early versions of dBase), and a hybrid of the two (best represented by Paradox).

R:Base can be classified as a DBMS that uses the centralized data storage approach because all data, indices, forms, and report definitions are stored in a centralized data repository. This means that the system tracks the program's information storage area and facilitates relational operations involving more than one data table. Hence, indices and relations among and between data tables will change dynamically.

With the separate file data storage approach, individual files are referred to as separate data bases. This approach requires that the user develop indices for all data files. Every change of tables or files requires that the file indices be updated before another query is possible. dBase II and III, as well as early versions of FoxPro are examples of DBMSs that use this approach.

Paradox is a middle ground between the centralized and separate data storage approaches. Paradox stores different data sets in separate, unrelated files. But, a data file and its indices, validation rules, form definitions, and report specifications are grouped together as a "family." Additionally, Paradox's QBE facility manages relational operations involving joins (i.e., a data retrieval operation) of multiple tables without specifically linking files or specifying the indices. More recent releases of dBase IV and FoxPro are moving toward this middle ground.

User Interfaces

R:Base, dBase IV, and FoxPro use a command-driven interface. Paradox has always used a system of horizontal menus displaying every function in the

system. In recent years, however, Microsoft Windows has moved toward a standard of using pull-down menus. Indeed, Microsoft Access and FoxPro are full-fledged, window-based DBMSs with a graphical user interface. Variations of the same sort of interface appear in command-driven products such as ORACLE, R:Base, and dBase IV. Paradox also adopted this approach with version 4.0. (All products provide some degree of mouse support.)

User Queries

Most of the software packages originally executed user queries through commands. Paradox's QBE represents the new standard for interactive query interfaces. With QBE, users work with a screen that displays the fields in tables to be referenced. The user points and clicks on fields to be included in the query and defines the criteria that will constrain specific fields. These queries can be saved and incorporated into programs. The other products offer interfaces that resemble Paradox's; but, in actuality, these are "command builders," that help build a command set in the product's query language.

Microsoft Access offers a unique graphical QBE that enables the user to directly link data from multiple sources, visually create joins among them, and update the data. This visual table-joining feature makes the generation of complex queries easy and extremely quick.

Reports

All of the software packages offer "what-you-see-is-what-you-get" (i.e., WYSIWYG) interfaces that allow users to place fields on-screen as they should appear in the report. However, the packages incorporate query results into reports differently. In Access, Paradox, ORACLE, and FoxPro, a query specification is part of the report definition process. R:Base and dBase IV, however, can base a report on a "view." Some packages also permit "parameter passing" when executing a report.

All of the products offer either language functions or report generator features that allow calculated report variables to be associated with each detail record in the report based on a look-up to another table.

APPLICATION DEVELOPMENT

All of the software packages enable users to design custom menus that provide access to all of the various system functions, to customize the screen display for viewing and editing data, and/or to automate complex processing tasks. Sophisticated programming languages and interactive interfaces for designing forms, menus, and reports are standard across all the packages with some minor differences.

Programming

All of the software packages have powerful programming languages, offering a wide range of functions for arithmetic operations, string manipulation, and reading and writing of data. Microsoft Access offers a powerful, extensible, and structured programming language called Access Basic Code (i.e., ABC). The ABC enables users to write sophisticated data base applications. Coupled with this capability is a complete set of debugging tools called: the integrated development environment (IDE). Paradox is especially good for novices because it comes with a macro record that saves a user's menu selections as programming code. The user can then expand on this code to create complex programs. Command-driven products like dBase IV and FoxPro require that users enter commands.

Custom Forms

The interactive screen generators of dBase IV and FoxPro actually produce program source code, while other packages use commands to write data to the screen where form design must be accomplished separately with extra code. R:Base uses forms like subroutines in which control passes to the form and returns it to the calling program once the user has finished editing or viewing the data with the form. Paradox requires coding for this, but its programs simulate the actions of interactive users working with a form. Microsoft Access and ORACLE both are similar to Paradox in that they permit the creation of sophisticated forms without any programming. ORACLE uses a menu-driven user interface to capture the user's specifications and combines that with the ORACLE data dictionary to generate a forms application. Microsoft Access permits users to build forms easily using a visual form-generation tool called the FormWizards.

All of the form designers offer interactive facilities for placing text and fields on the screen. The default format file produced by the forms generator provides a good starting point for customizing the forms to perform complex and sophisticated functions.

EVALUATION

All of the software packages considered offer the user a portfolio of features that are both sophisticated and versatile. It is also worth mentioning some of the unique strengths and weaknesses of the individual products.

R:Base is a true-to-form relational DBMS and is one of the easiest to operate, but its slow performance is a great liability to application developers and end users alike.

FoxPro for Windows outperforms all other products in terms of processing speed. This advantage becomes more dramatic as the size of the data base increases. Its usability and the efficiency of its interactive query interface also

place it at the top of the overall ranking. One potential drawback to FoxPro is the longevity of vendor support. Since Microsoft has purchased Fox Software, Inc., the maker of FoxPro, it remains to be seen whether Microsoft will continue to support FoxPro as a separate product or whether it will be subsumed under Microsoft's own DBMS, Access. FoxPro outperforms dBase IV (its Xbase platform counterpart) in many aspects, including performance, end-user capability, application development functionality, and ease of use.

ORACLE's greatest strength is its versatility in terms of data and source code portability. ORACLE is the most capable of the DBMSs to span multiple platforms and multiple data formats. Its single greatest disadvantage is the high cost of converting the existing source code into ORACLE code.

Microsoft Access offers unique, visual-oriented data-query-interface capabilities. These capabilities, combined with its help functions and graphical user interface, make it an extremely easy-to-use package. Microsoft Access received the highest ranking for ease of use and QBE functionality.

Table 3-1 illustrates the performance of the DBMSs, which we evaluated according to the criteria previously discussed.

Available Enhancements to Standard Structured Query Language Capabilities

Our evaluation considered products offering full data base management capability, including interactive query tools, forms and report generation, and the ability to create tables and indexes. In most cases improvements in functionality are obtained through add-on packages. In the following section we evaluate four of the more popular COTS packages.

Packages Evaluated

We evaluated the following structured query language (SQL) products:

1. Paradox and Paradox SQL Link,
2. ORACLE Tools and Database,
3. DataEase/SQL, and
4. Advanced Revelation and SQL Server Bond.

Evaluation Criteria and Features Evaluated

We evaluated the software packages using the following criteria: power, usability, performance, versatility, error handling, ease of learning, and ease of use.

Table 3-1.
Performance Matrix for Workstation-based DBMSs

Features	Data base management systems software						Weights %
	Access	dBase IV	FoxPro/ Windows	ORACLE	Paradox	R:Base	
Source code portability	3.0	2.0	3.0	5.0	4.0	3.0	10
Data portability	4.0	2.0	3.0	5.0	3.0	3.0	10
Performance	3.0	3.0	5.0	3.0	3.0	1.0	20
QBE facility	5.0	3.0	4.0	3.0	4.0	3.0	10
Unlimited distribution[a]	1.0	1.0	1.0	0.0	1.0	0.0	10
Ease of use	5.0	3.0	4.0	3.0	4.0	4.0	10
DOS supportability[a]	0.0	1.0	0.0	1.0	0.0	1.0	10
Convertibility	2.0	4.0	5.0	1.0	3.0	2.0	10
Software longevity	5.0	3.0	3.0	5.0	5.0	4.0	10
Weighted score	3.1	2.5	3.3	2.9	3.0	2.2	100

Note: 4.0 – 5.0 = excellent, 2.0 – 3.0 = good, 1.0 – 2.0 = fair, and 1 = poor.
[a] 1.0 = supports feature and 0.0 = does not support feature.

We considered several key SQL server features in performing our evaluation: ability of the front end to convert server data formats into native formats, data interfaces, data transfer capabilities, SQL support, application development, and cross-platform transportability.

EVALUATION

Overall, Paradox ranks first in ease of use, error handling, and performance, but last in versatility. Although the program supports more server platforms than the other products, many features available for native data cannot be used with server data.

ORACLE Tools' powerful application development tools work only with ORACLE data bases. Applications generated using SQL*Forms outperform all competitors; reports and interactive queries achieve average performance.

DataEase/SQL rates first in ease of learning but last in performance and error handling. All of its standard SQL features work well with server data for

excellent application portability, but the advance application development features are weak.

Advanced Revelation's many complex features make it the most difficult to learn and use. Excellent performance in custom applications is offset somewhat by mediocre performance in interactive queries and reports.

EXECUTIVE INFORMATION SYSTEMS

An executive information system (EIS) is a system that has, at the minimum, the capability to do the following:

- retrieve data across a wide range of platforms and data formats,
- analyze data in a variety of ways,
- present information graphically,
- create ad hoc reports,
- offer customized application development tools to build applications that automatically perform routine tasks.

Software Packages Evaluated

We evaluated three products: Power Play v.2.0, Forest & Trees for Windows v.2.0, and Lightship v.3.01. All of the products reviewed provide simple data access, but each retrieves the data that it works with in fundamentally different ways.

EVALUATION CRITERIA AND FEATURES EVALUATED

We evaluated the software packages using the following criteria: power, usability, performance, versatility, ease of learning, and ease of use.

Each software package was evaluated in terms of ease of use and flexibility when dealing with different data formats. Packages were also examined for their ability to establish and maintain live links with data through protocols such as dynamic data exchange, etc.

Power Play

This program extracts its data elements and creates a specialized data base. The program can work with virtually any file format as long as it can be

converted into flat ASCII file format. The Power Play program is ideally suited to applications that do not require up-to-the-minute information, because the data base is predicated on extracted data that have no live links to the original data base.

Forest & Trees for Windows

Forest & Trees (F&T) establishes live links to its data and is designed to run like an electronic dashboard that monitors data. When it encounters data that violate any of the predefined data conditions specified by the user, it sets off a flag. F&T excels with applications that need to monitor data closely and set alarms for exceptions. In addition, F&T can augment its preprogrammed applications by submitting ad hoc SQL queries against the live data base.

Lightship

Like F&T, this program constructs live links to data, but its data gateway is different. Lightship relies solely on the Dynamic Data Exchange (DDE) protocol of the Windows 3.x environment. Naturally, this limits accessibility to those applications that support DDE, such as Excel. In response to this deficiency, the maker of Lightship has offered an add-on product, called Lightship Lens, to provide access to various file formats like dBase, Paradox, SQL Server, and DB2.

Using DDE has its pros and cons. The automatic update of information is a distinct advantage. However, for all the DDE connections to work, all of the applications must be memory-resident. Moreover, few applications fully support the DDE protocol. Lightship, however, offers a highly graphical environment, superior to the other packages.

EVALUATION

Forest & Trees for Windows and Lightship are very close in their capabilities; however, since USACE is currently using F&T, it is the logical choice for providing the EIS capability.

ANALYSIS TOOLS AND DECISION SUPPORT CAPABILITY

The manpower management process requires a significant amount of ad hoc analyses to support decision-making. This functionality is frequently referred to as decision support capability. Some of those analyses are repetitive, frequently needed, and can be thought of as ongoing decision support requirements. Other analyses address specific issues that may never be raised again. All analyses require the ability to perform graphical interpretations. In general, these

requirements can be met with spreadsheet and/or statistical analysis packages. In the following subsections we evaluate both types of software.

Spreadsheet Packages

In general, many staff members' needs can best be met by the functionality of a spreadsheet. Further, we assume that this type of functionality should be combined with the ability to use live data base links -- so that recurring analyses can be established and updated automatically and so that data can be easily transferred (for one-time analyses). The software packages we evaluated possess these capabilities and are discussed in the following subsections.

Evaluation Criteria and Features Evaluated

We evaluated the software packages using the following criteria: power, usability, performance, versatility, error handling, ease of learning, and ease of use.

Software Programs Evaluated

We evaluated three of the major Windows-based spreadsheet products: Lotus 1-2-3 Release 4 for Windows, Quatro Pro, and Excel. Of these three products, Lotus 1-2-3 is the leader due to major enhancements made to its capabilities. The new version offers improved 3-dimensional (3-D) interface, enhanced charting, 3-D worksheets, powerful data base query tools, and a flexible version control feature called the "Version Manager (VM)."

Lotus 1-2-3 Release 4 for Windows adopted many of the mouse conventions used by competing products such as "drag and drop" for moving and copying. One can also select contiguous as well as discontiguous columns or ranges when executing commands.

Lotus 1-2-3 Release 4 for Windows has a 3-D worksheet feature that is a clear advantage over Excel, which only uses 2-D worksheets. Still, Borland's Quatro Pro for Windows has greater flexibility in its 3-D spreadsheet interface as demonstrated by its ability to link spreadsheets into named groups for formatting in a manner that is impossible in Lotus 1-2-3.

Lotus 1-2-3's single greatest advantage in workgroup computing is the addition of the Version Manager. VM lets you record and organize versions, then toggle between them. VM automatically records a user's ID and the date for each version. With alternative versions for ranges, the user chooses the versions he wants grouped together and then stores them as a named scenario. This mix-and-match flexibility of versions and scenarios lets the user handle complex mathematical models easily.

Evaluation

Overall, Lotus 1-2-3 Release 4 for Windows is a major innovation in spreadsheet packages demonstrated by its many improved features, particularly because of its unique version control system that gives users extensive flexibility in working with complex models. This would be especially beneficial to CEMIS users performing decision-support analyses. Additionally, Lotus 1-2-3 has reasonably advanced statistical and simulation capabilities that can provide additional analysis functionality.

Statistical Analysis Software Packages

Our evaluation of statistical analysis software packages focused on PC-based, general-purpose statistics packages that have some capability to manipulate data as well as the ability to merge data from two separate files into one new file for analyses.

Evaluation Criteria and Features Evaluated

We evaluated the software packages using the following criteria: power, usability, performance, versatility, error handling, ease of learning, and ease of use.

Software Programs Evaluated

We evaluated the following packages:

1. SPSS for Windows,
2. Statistical Appreciation Software (SAS),
3. Systat for Windows,
4. Statgraphics,
5. Statistical,
6. P-Stat, and
7. S-Plus for Windows.

Our assessment of the software packages included evaluations based upon their performance in three key areas of data management, basic statistics, and advanced statistics. With respect to data management, we assessed the package's depth and sophistication in handling multiple files especially with different file formats. In the area of basic statistics, we looked at the handling of descriptive statistics such as mean, cross-tabs, variability measures – to name a few. We

also looked at procedures such as t-tests, chi-square tests, and simple regression and correlation. For advanced statistics, we focused on multivariate hypotheses-testing procedures.

Evaluation

SPSS for Windows, although not the most statistically powerful package, is perhaps the most user-friendly of the packages reviewed. It also can directly access the data structures being contemplated for CEMIS making advanced statistical analyses reasonably easy. However, the need to perform advanced statistical analyses such as lagged, time-series regression analyses does not occur frequently. We believe that most of the statistical analyses required by users can be accomplished within the functionality of any advanced spreadsheet package. Therefore, we do not recommend including a separate statistical analysis capability in CEMIS. When an office does need that capability, we recommend that SPSS for Windows be used in a stand-alone mode.

Summary

The technologies available to meet the functionality needs of CEMIS are impressive. We found that COTS software can meet all of the basic functionality requirements. We believe that a flexible, responsive management system can be developed when those functionalities are combined with the development of calculation and interface modules. In Chapter 4 we recommend a combination of technologies that could provide such a management system.

CHAPTER 4

Recommended New System

RATIONALE FOR THE PROPOSED SYSTEM

Our choice for the recommended system was driven by the need to satisfy certain key requirements. First, USACE's leadership expressed the need for a system that is easy to learn and use, easy to implement in the field, and that can be used by field offices as a planning and management tool.

Second, the system must possess certain functional capabilities. It should be capable of estimating the manpower required to execute USACE's programs. It should be capable of supporting the allocation process, of providing program information in useful ways, and of tracking utilization information. It should have the ability to support "what if" analyses. It must also be able to draw upon various sources of data (i.e., district-level inputs) as well as data from existing data bases such as the Corps of Engineers Financial Management System (CEFMS) and future data bases such as the Project Management Information System (PROMIS).

Third, the ability to provide a consistent view of USACE manpower is critical in a period of declining resources. This requires a system that provides a unified, standardized, relational data base from which both standard and ad hoc joint reports can be generated through a seamless system that will provide consistent information regardless of whether a user is from the Military Programs, Civil Works, or Resource Management Directorate.

Fourth, there is a need to provide USACE with capabilities that existing manpower systems lack; specifically, in the case of CERAMMS, an ability to break down manpower data to the project and district levels of detail. With respect to FORCON, the new manpower system must be able to provide decision support as well as forecasting capabilities. It should also include built-in logic that includes the ability to perform functions such as the following:

- constraining manpower allocations to ceilings within dollar constraints;
- setting manpower maximums, by function, at the district level;
- establishing contracting-out our targets/constraints for districts; and
- performing statistical validity checks for usage factors within "like" Army command and control system engineering groups that capture all USACE manpower data and not just the data associated with the Military and Civil

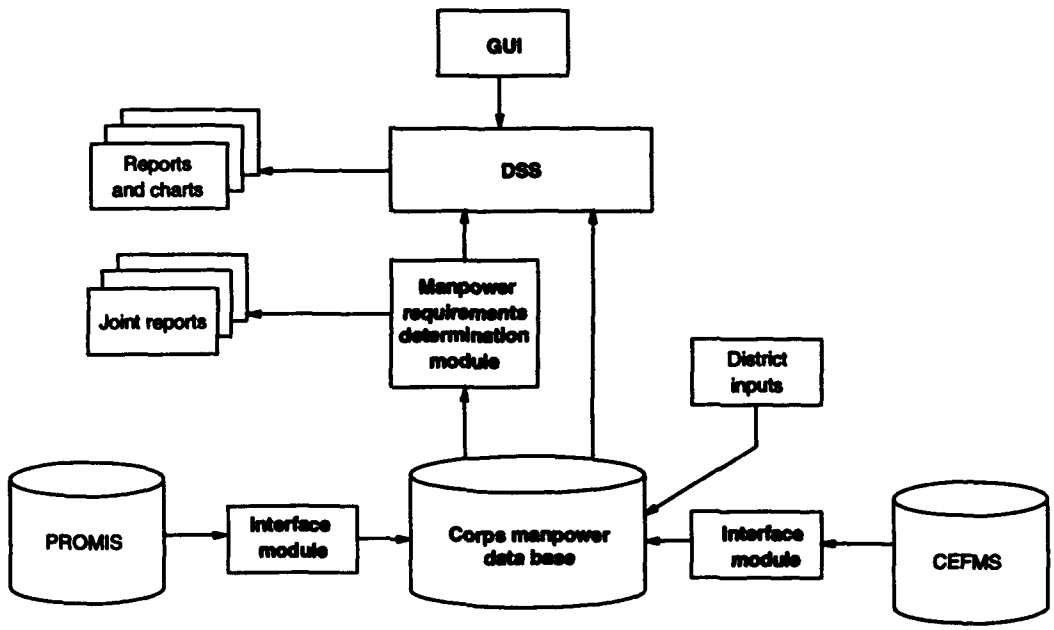
Works programs (we assume for the purpose of this analysis that that information will be extracted from other existing systems).

Finally, producing reports on accurate manpower utilization is another capability expected of the new system that is currently unavailable in either CERAMMS or FORCON. USACE is currently selecting a standardized reporting system from existing Corps systems that will generate reconciled manpower utilization information. This information will be generated at the district level and reported to Headquarters in an aggregated form. Utilization data can be captured by CEMIS from this new standard system at the district level and passed to Headquarters, USACE, along with other manpower data. This new system is scheduled to be fielded by the end of FY94, which would coincide with prototype fielding of CEMIS.

LOGICAL DESIGN

Top-Level View

Figure 4-1 depicts the top-level logical design of CEMIS. The proposed system will have a graphical user interface (GUI) front-end. The GUI will give users the option of executing a decision support system (DSS) — which includes an executive information system, the manpower requirements determination module, or the manpower data base.



Note: CEFMS = Corps of Engineers Financial Management System; DSS = Decision Support System; GUI = Graphical User Interface; PROMIS = Project Management Information System.

Figure 4-1.
Corps of Engineers Manpower Information System — Top-Level View

Through the use of either the DSS or manpower requirements module, users will be able to generate output (i.e., reports and charts) by drawing upon the data contained in the manpower data base. This data base will, in turn, receive its inputs from district-level data entry or from an interface module that will update the data base from district data sources such as CEFMS or PROMIS that currently exist or will exist in the future. This concept envisions a centralized USACE data base that is an aggregation of district data with each district retaining its own data. The data will be transferred, both to and from Headquarters, using USACE's wide-area network. Eventually, creation of a distributed data base is possible. However, we do not recommend following this approach while other major system initiatives are being completed. Establishing a distributed data base is a difficult task that could become almost impossible to accomplish when financial management and project management systems are being fielded at the same time.

Manpower Requirements Determination Module

Figures 4-2 and 4-3 depict the logical design of CEMIS from the perspective of the Civil Works and Military Programs Directorates, respectively. This is somewhat misleading because CEMIS is conceptualized as an integrated system with a single relational data base and a single requirements determination module that will have similar outputs for both the Military and Civil Works programs. Although integrated, the algorithms to forecast manpower requirements will differ for different types of work. For example, managing dredging operations will not use the same estimating algorithms as managing military construction. Likewise, the algorithms must also account for programming differences e.g., some projects are funded annually and some are funded with a lump sum with multi-year execution). To ignore those differences would result in a fundamentally flawed forecast. We show two sets of such algorithms to illustrate this distinction even though the programming would actually exist in the same module.

The DSS depicted in both figures gives the user the ability to perform specialized or ad hoc decision support analyses not available in the standard processing routines contained within the manpower modules.

District Version

Figure 4-4 depicts the logical design of the future manpower system that will be implemented at the District level. It will have a GUI front end, which will permit the user to choose between using the DSS or the manpower requirements determination module. The DSS will provide the ability to generate reports that are specific to an individual directorate as well as ad hoc reports. Many of the required features discussed previously will apply in the case of the District version of the system.

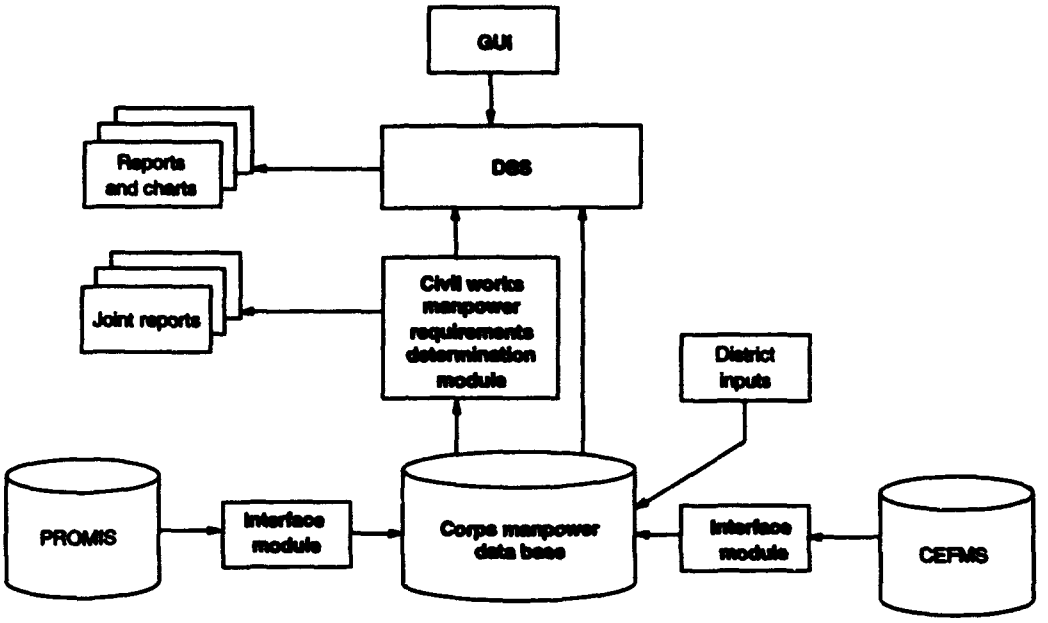


Figure 4-2.
Corps of Engineers Manpower Information System — Civil Works Module's Logical Operation

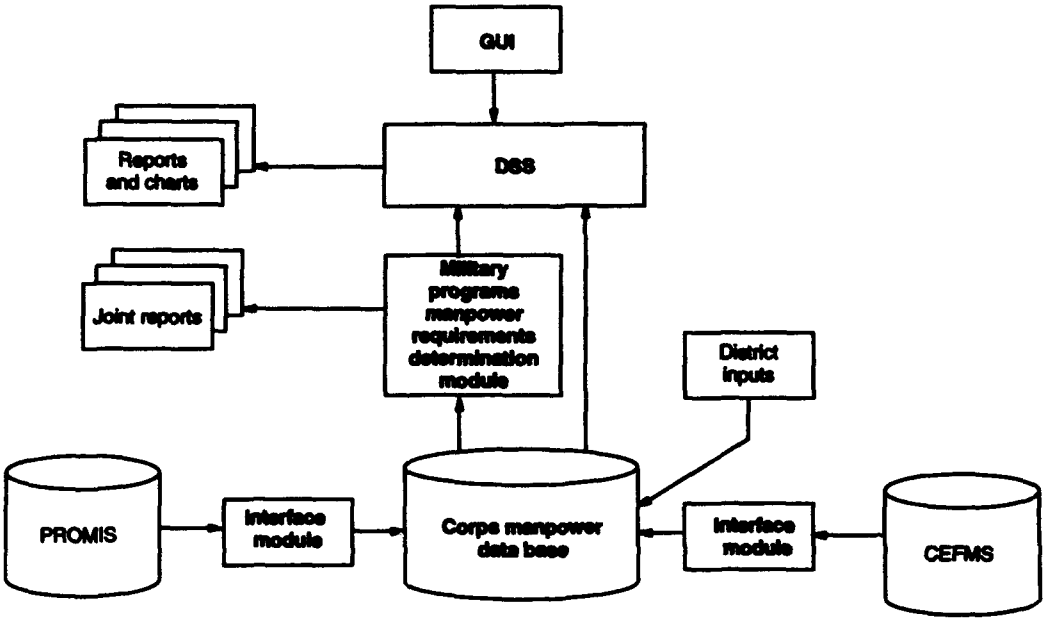


Figure 4-3.
Corps of Engineers Manpower Information System — Military Programs Module's Logical Operation

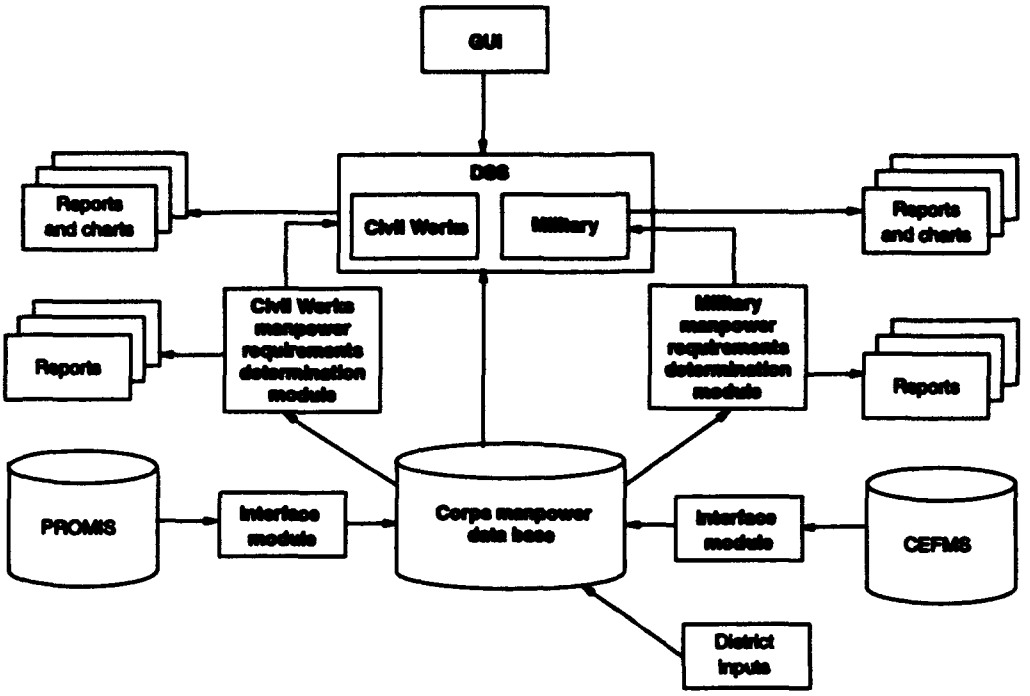


Figure 4-4.
Corps of Engineers Manpower Information System — District Version

HEADQUARTERS, U.S. ARMY CORPS OF ENGINEERS VERSION

Figure 4-5 depicts the logical design of the version of the system that will be implemented at Headquarters only. The only substantive difference between the Headquarters version and District version is the inclusion of two additional modules, namely, the geographical information system (GIS) and the executive information system (EIS).

The GIS will give decision-makers the ability to view manpower allocation requirements by geographical location. The EIS will provide high-level users such as HQ-based managers with the ability to perform standardized data retrieval routines and standardized data analyses along with information (displaying functions across platforms and across various data tables).

The Headquarters version serves as the master data base that will receive periodic updates from the field. This way, a USACE-wide assessment of manpower requirements and utilization can be performed.

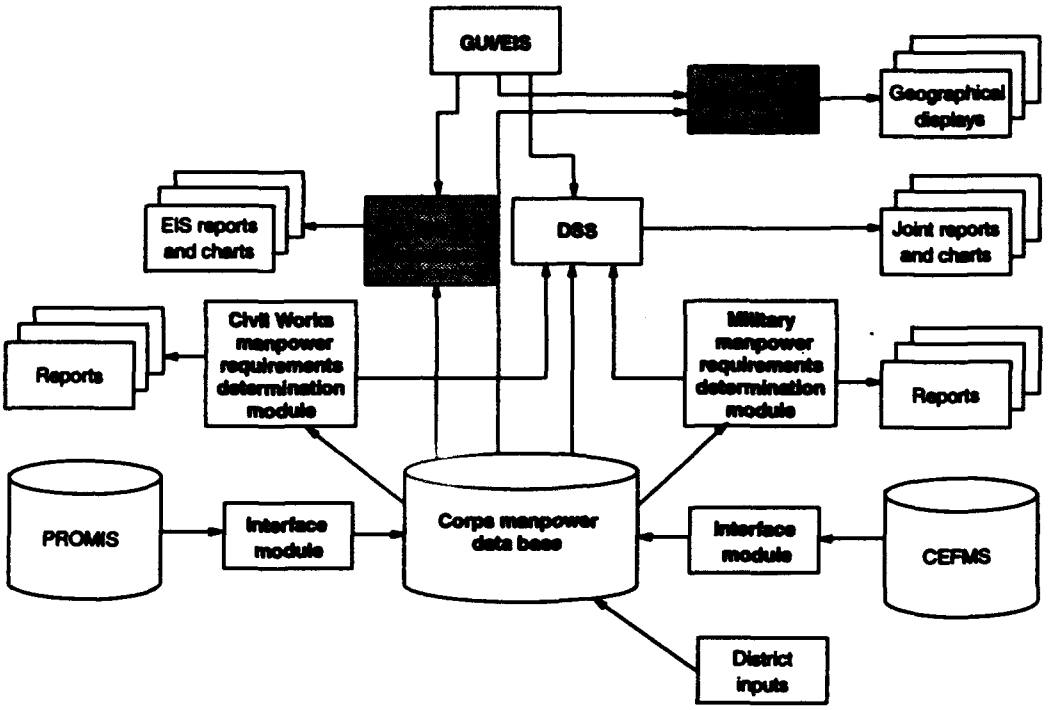


Figure 4-5.
Corps of Engineers Manpower Information System — Headquarters, U.S. Army Corps of Engineers Version

DATA BASE

Table 4-1 illustrates the functional crosswalk between the functional areas of the Civil Works Directorate and those of the Military Programs Directorate. The "Joint" column represents the way in which the functional areas of the individual directorates will be aggregated for the purpose of generating joint reports and/or charts.

Figure 4-6 depicts the logical design of the CEMIS data base. Nine primary tables are related to the Civil Works Directorate and four tables are related to the Military Programs Directorate. Civil Works projects and programs require data elements that are stored in the following tables: Project, Organization, Funding, Appropriation, Function, Contracting, Average Cost, Engineer Reporting Organization Code (EROC), and To-From.

Table 4-1.
Functional Crosswalk Between the Civil Works Directorate and the Military Programs Directorate

Civil Works Directorate	Joint	Military Programs Directorate
Admin. & advisory	Admin. & advisory	Admin. & advisory
Planning	Planning	Not applicable
Engineering	Engineering	Engineering
Construction	Construction	Construction
Operations	Operations	Not applicable
Program & project mgmt.	Program & project mgmt.	Program & project mgmt.
Real estate	Real estate	Real estate
Research & development	Research & development	Research & development

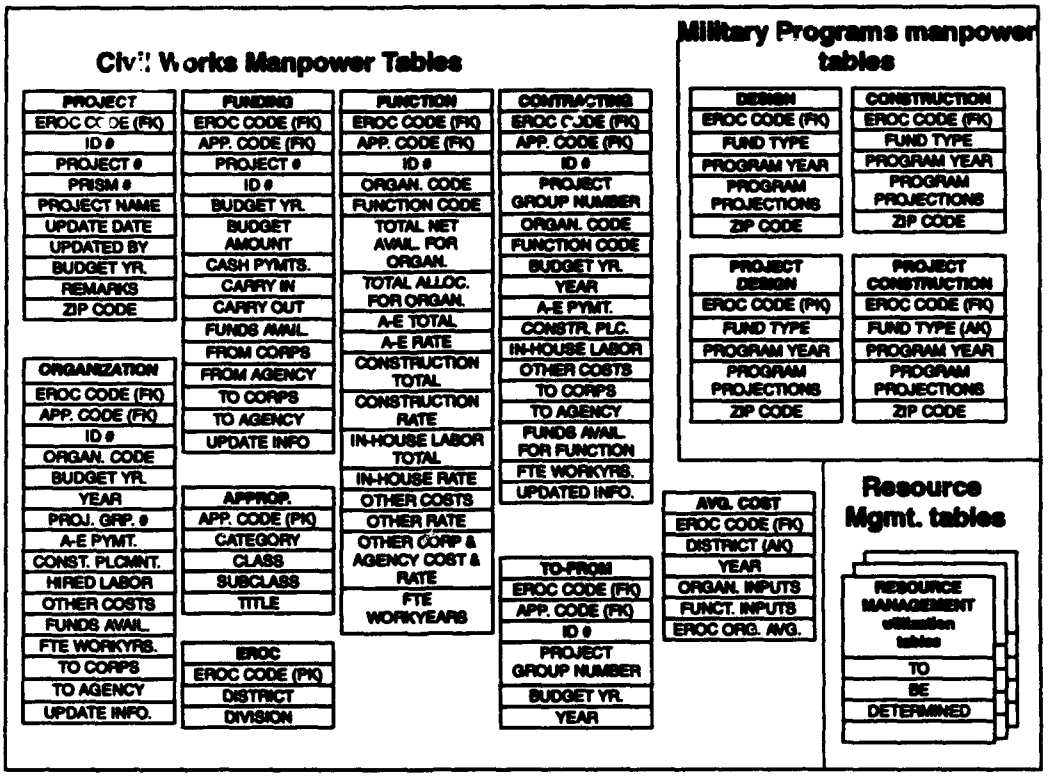


Figure 4-6.
Corps of Engineers Manpower Information System Data Base

The Military Directorate data elements fall within any one of four tables: Design, Construction, Project Design, and Project Construction.

The key fields within each table can be linked by either a primary key (PK), a foreign key (FK), or an alternate key (AK). A PK is the data element or set of data elements used to identify a unique instance of an entity. An AK is a second, third, or fourth choice of data element(s) that also can be used to identify each unique instance of an entity. An FK is the PK of a parent entity that can be found (via a process called migration) to a "child" entity instance.

System Output

Through the use of the manpower model data base, the CEMIS will be capable of generating new joint reports. These reports will provide manpower allocation and utilization information sorted in a variety of ways. Tables 4-2 and 4-3 depict sample manpower allocation summary report formats sorted by division and by type of program. Information about function sorted by organization would also be available (e.g., engineering staff at a district).

Table 4-2.
Corps of Engineers Manpower Allocation Summary by Division — Sample Report Format

FOA	Budget Year – 3		Budget Year – 2		Budget Year +5	
	Military Programs	Civil Works	Military Programs	Civil Works	Military Programs	Civil Works
HND	50	100	50	100	50	100
LMD	1,000	4,800	1,000	4,800	1,000	4,800
MRD	2,000	1,500	2,000	1,500	2,000	1,500
Division total	3,050	6,400	3,050	6,400	3,050	6,400
Lab total Sep. FOA total HQUSACE						
Subtotal						
Misc.						
Grand total	3,050	6,400	3,050	6,400	3,050	6,400

Table 4-3.
Corps of Engineers Manpower Allocation Summary by Function for Budget Year XX — Sample Report Format

FOA	LMV		MRD		TAD		Total	
	Military Pgms.	Civil Works	Military Pgms.	Civil Works	Military Pgms.	Civil Works	Military Pgms.	Civil Works
Admin.	103	121	35	41	2	2	140	164
Planning	24	28	12	14	2	2	38	44
Construction	42	49	39	46	2	2	83	97
Engineering	14	17	0	0	3	4	17	21
Operations	12	14	12	14	1	1	25	29
PPM	7	8	3	4	0	0	10	12
Real estate								
Subtotal								
Misc.								
Grand total	202	237	101	119	10	11	313	367

PHYSICAL COMPONENT DESIGN FOR THE SYSTEM

The major criteria considered when selecting the physical components for CEMIS were the need to ensure that the new manpower management system does not require hardware that is not reasonably available in USACE offices. The goal is to avoid hardware cost and/or procurement problems and to concurrently upgrade users' hardware and software capabilities as part of fielding CEMIS. We believe that a new manpower management system should strike a balance between enhancing the capabilities of users without attempting to push the state of the art. The physical design specified in the following subsections strikes that balance.

System Hardware

We believe the following is the minimum system configuration for each user terminal at the field operating activities (FOAs):

1. a personal computer with an 80486 microprocessor chip and 33 MHz processing speed, 8 MB of RAM, and a 200-MB hard drive;

2. one 3.5" high-density disk drive and an optional 5.25" 1.44-MB floppy disk drive; and

3. associated peripherals, including a VGA color monitor, a keyboard, a laser printer, a communication port, and a mouse.

A file server for a local-area network (LAN) at the FOAs is optional, although most districts are implementing this technology. Naturally, the requirements of a LAN file server dictate that it have all of the features mentioned previously, as well as more RAM, considerably more hard-drive space, and possibly multiple communication ports.

At HQUSACE, each user terminal will have the identical system configuration requirements. As in the case of the FOA, a file server for a LAN is optional but, if chosen, it would require user terminals configured with additional capacity for RAM and storage space. We further recommend that the system include a color printer for exploiting the output provided by the decision support and GIS capabilities to the fullest extent possible.

System Software

Users operating CEMIS at the FOAs will require the following:

1. DOS version 5.0 or greater,

2. Windows version 3.1 or greater,

3. Lotus 1-2-3 version 4.01 for Windows,

4. FoxPro version 2.5 for Windows, and

5. Communication software (either ProComm Plus for Windows or DynaComm version 3.1) or another USACE E-mail system.

Users operating CEMIS at HQUSACE will require all the FOA system software plus the following additional software:

1. Mapinfo for Windows version 2.1 and

2. EIS software.

Proposed Technology of New System

Figure 4-7 depicts the recommended logical design of CEMIS with our associated choices of brand name software. We recommend that the front-end GUI be designed either in Microsoft Windows or Visual Basic. With respect to the DSS, we recommend use of the latest release of Lotus 1-2-3 for Windows (i.e.,

version 4.01). We recommend that Mapinfo be selected for the GIS and that Forest & Trees be used for EIS development.

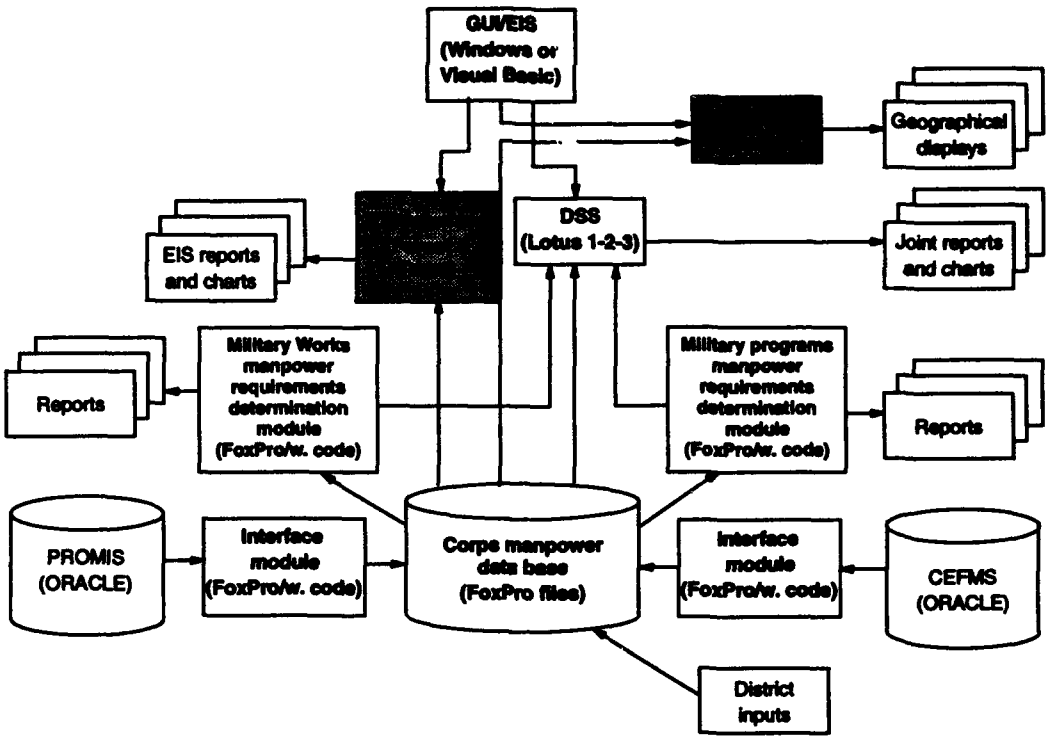


Figure 4-7.
Corps of Engineers Manpower Information System — Brand Name Software

Our proposed choice for a relational DBMS is FoxPro for Windows v.2.5. This choice is based upon several conclusions. First, FoxPro scored highest in the performance benchmark tests whose results are depicted in Table 3-1. FoxPro's high performance, excellent user interface, and low convertibility costs make it the ideal choice. Second, since FORCON is currently coded in Xbase-compatible code, the transition to the FoxPro for Windows platform will be a straightforward one. Finally, the base of users and current technical support staff members understand and can operate a new application coded in FoxPro for Windows.

One caveat that should be considered is the fact that the future of FoxPro, at least in its current configuration, is quite uncertain since Microsoft has acquired Fox Software, Inc., the maker of FoxPro. It is quite likely that it will modify future versions of FoxPro such that most of its functionality will be subsumed under Microsoft Access. Hence, today's users of applications coded in FoxPro may face the prospect of fading software support; indeed, the possibility of being forced to transition to a completely different system (i.e., Access) in the next few years is high. It is our best estimate that FoxPro will remain a viable system for at least the next 3 years. The worst-case scenario is that FoxPro will not be supported at that time and that the FoxPro code will have to be translated into a

FoxPro-compliant system such as Microsoft Access. The remaining functionality of CEMIS should not be affected because it is reasonably certain that with standards such as dynamic data interchange and SQL, the data base of this compliant system could be easily accessed by the DSS, GIS, and EIS software. Thus, the worst-case scenario would be no more difficult to resolve than converting the system; that might save money if FoxPro continues to be supported.

SUMMARY AND RECOMMENDATIONS

We believe that significant improvements can be made in the current manpower mar :ment systems. A unique opportunity exists to develop an integrated Class VI system for managing USACE manpower in a way that incorporates appropriate technologies and provides USACE managers with a consolidated view of their uses of human resources. That integration will require a change in the manpower management process at Headquarters and at the division and district levels. A process is needed that provides adequate representation by all organizations involved yet has some centralized direction. The development of this process is perhaps as important as the development of the software itself, and it should be done parallel with system development through a steering group made up of those offices currently involved in manpower management.

Additionally, maintaining two or more independent systems involves considerable redundant effort. Two systems must be maintained and upgraded and every organization concerned with manpower management must support the administrative requirements associated with two processes. Two independent manpower management systems may be a luxury that USACE cannot afford in a period of decreasing Headquarters resources.

We recommend that USACE establish a single manpower management system. That system should provide the functionality identified in this report and utilize the communication capabilities of the Corps' wide area network. System development should include a parallel effort to re-engineer the manpower management process. Significant process changes are likely to result from this effort. The combination of needed improvements to existing systems, reductions in Headquarters staff, and changes in utilization reporting presents a unique opportunity for change. If this opportunity is missed, it is likely that the key participants in manpower issues – the Civil Works Directorate, the Military Programs Directorate, and the Resource Management Directorate – will pursue independent system upgrades that in all likelihood will perpetuate the inconsistencies and redundant expenses that exist today.

APPENDIX A

Corps of Engineers Resource and Military Manpower System

Corps of Engineers Resource and Military Manpower System

Overview

The development of the Corps of Engineers Resource and Military Manpower System (CERAMMS) manpower forecasting modules was based upon two assumptions: (1) that the U.S. Army Corps of Engineers (USACE) mix of project size and complexity for future program years can be related to the mix for historical program years and (2) that USACE's historical resource requirements for engineering and construction management services are comparable to those found in other government agencies and the private sector.

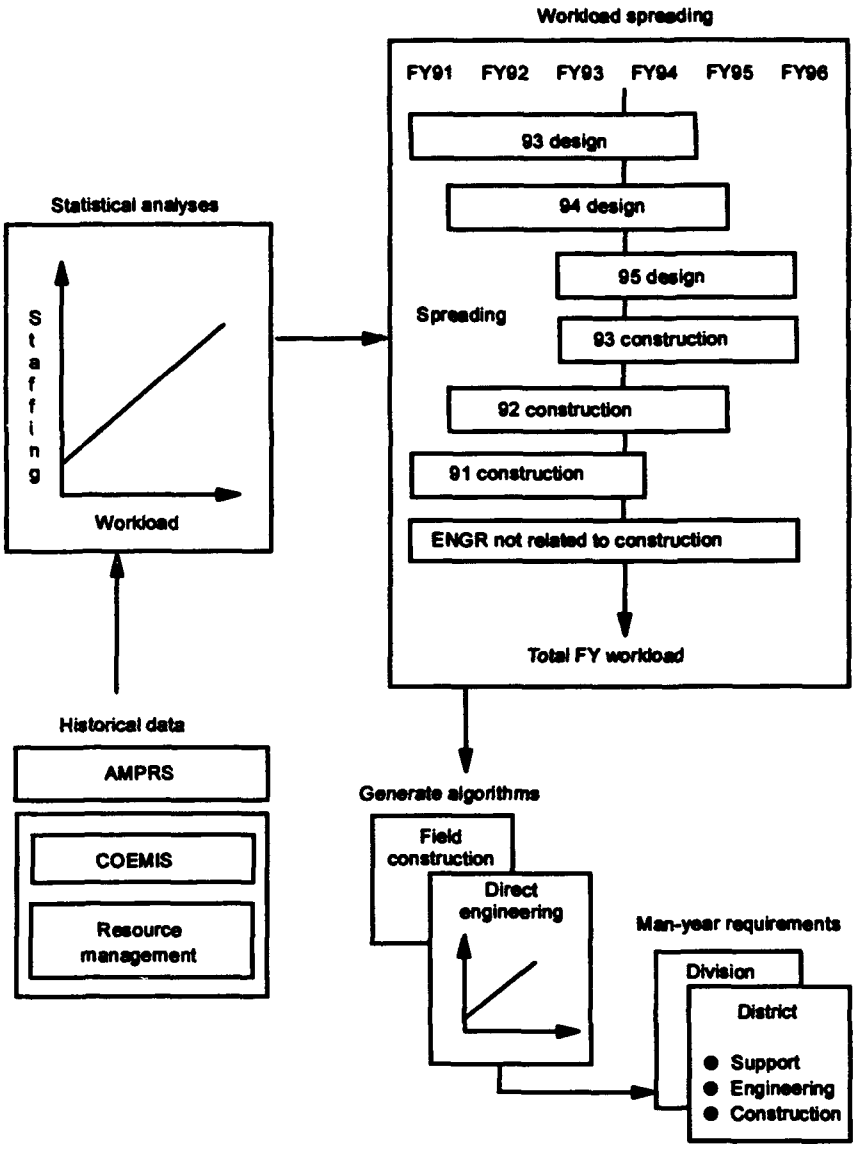
The initial step in developing the CERAMMS forecasting modules was to create a structure that related the mix of projects in the anticipated workload to historical USACE data. Analysis of historical USACE data showed that the type of funding used to support a project gives a good indication of project differences and can be used as the basis for structuring the mix of projects to determine manpower requirements. By dividing the military program into fund types and using the historical project mix in those fund types, inputs to the manpower forecasting modules can be generated from existing DoD workload forecasts. That method is valid unless major changes in priorities alter the relatively constant historical project mix within fund types.

Since USACE's costs for design and construction management services have been shown to be comparable to those of other Federal, state, and local government agencies and large private-sector corporations, properly sampled historical USACE data can be used to generate requirements factors that reflect industry standards.

One of the major objectives in developing CERAMMS was to minimize the resources needed by maximizing the use of existing data sources for developing, and subsequently maintaining, the model. USACE currently maintains two large project and cost data bases: the Corps of Engineers Management Information System (COEMIS) and the Automated Management and Project Reporting System (AMPRS). Those data bases, however, had to be supplemented with information that was not available from either one of them. Thus, a field data call was issued. Information from that call and from the two data bases formed the combined data base used to develop the algorithms for the forecasting models.

The development of each of the forecasting models followed a similar process. The combined data base was first examined to determine where possible relationships might exist – between the dependent variable (man-years or funding) and the potential independent variable(s). These hypothesized relationships were then examined statistically to determine whether a relationship

did, in fact, exist, and if it did, to quantify it. The relationships that were quantified through the statistical analyses were used to develop algorithms for building forecasting models. Figure A-1 depicts the model development process.



Note: AMPRS = Automated Management and Project Reporting System; COEMIS = Corps of Engineers Management Information System; and ENGR = engineering.

Figure A-1.
Model Development Process

The outputs of the forecasting models (forecasts of workyear requirements) were then compared with actual utilization to validate the reliability of the models.

THE USACE MANPOWER FORECASTING MODEL

The outputs of the CERAMMS manpower forecasting model are multi-year forecasts of the workyears required to provide engineering and construction services for the ongoing and planned military program. Workyear requirements are calculated by fund type and summarized in three customer categories: Army installation support, other Army support, and non-Army support. This functional display of manpower requirements facilitates the analysis of the impact of changes in specific fund types and readily supports the "what if" scenarios that are an integral part of manpower management.

Historical data were used to develop the CERAMMS manpower forecasting model. A statistical analysis of actual manpower utilization and work accomplished was used to derive the forecasting algorithms. The data analyzed were selected from a sample of USACE Districts. The analysis was based on single variable and multivariate regressions that relate the manpower actually utilized to the dependent variables under consideration. Although workload was the most significant factor affecting manpower requirements, some other factors such as economies of effort realized on large projects and the number of active construction contracts were also found to be important. Figure A-2 depicts the major components of the CERAMMS manpower forecasting model.

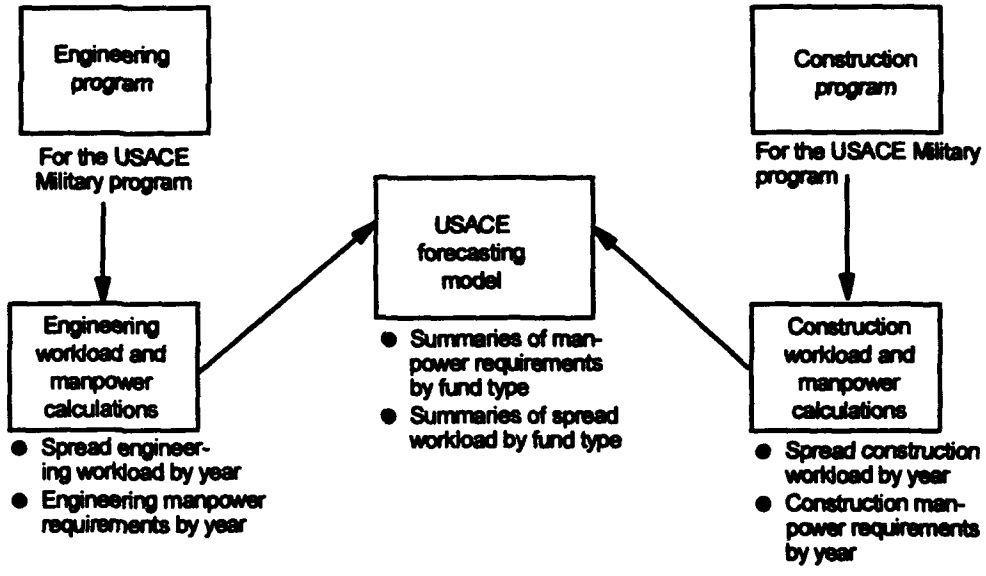


Figure A-2.
USACE Manpower Forecasting Model Major Components

The inputs to the CERAMMS forecasting model are the actual and planned programmed amounts (PAs) for each of the years under consideration. Those years include the year for which outputs are sought, the 3 years preceding it, and the 2 years following it. Data for this range of years are needed because of the multi-year nature of design and construction program execution. Projects that

are programmed for execution in a given year must be designed before that year. Similarly, since completion of construction projects normally requires more than 1 year, construction workload often continues past the execution year. Much of the PA information for future years is based upon "best guesses" and extrapolation of historical trends. Assumptions related to program execution are secondary inputs to the model.

The development of manpower forecasts begins with assumptions and data inputs and ends with a presentation of manpower requirements by fund type. Workload is measured by inflation-adjusted PAs and is obtained from a combination of existing USACE automated data bases and estimates by program managers. The assumptions that the model considers are the number of available man-hours per man year, the estimated percentage of in-house design work that will be done, the percentage of projects that will not survive the budget review process (i.e., mortality rate), the percentage of engineering not related to construction to be done in-house, and the Operation and Maintenance, Army positions. Once the input data and assumptions are entered, the calculation of manpower requirements begins.

The first step in the calculation is to identify the year or years over which a particular PA will be executed. Workload (inflation-adjusted PA) is spread by factors that have been developed from a detailed analysis of a multi-year sample of historical USACE design and construction data (see Figures A-3 and A-4). The factors account for the duration of projects, variances in project start dates,

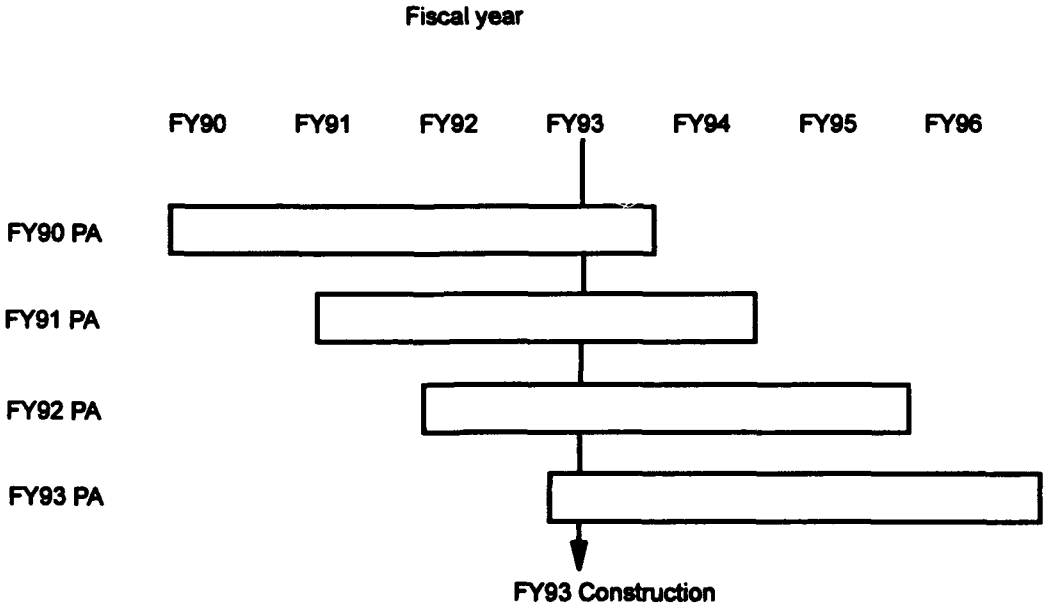


Figure A-3.
Design Workload Spreading

historical patterns of completion, mandated goals (such as 35 percent design completion before submission to Congress), and the historical mix of projects. Separate sets of spreading factors have been developed for in-house design and architect-engineer (A-E) design and construction.

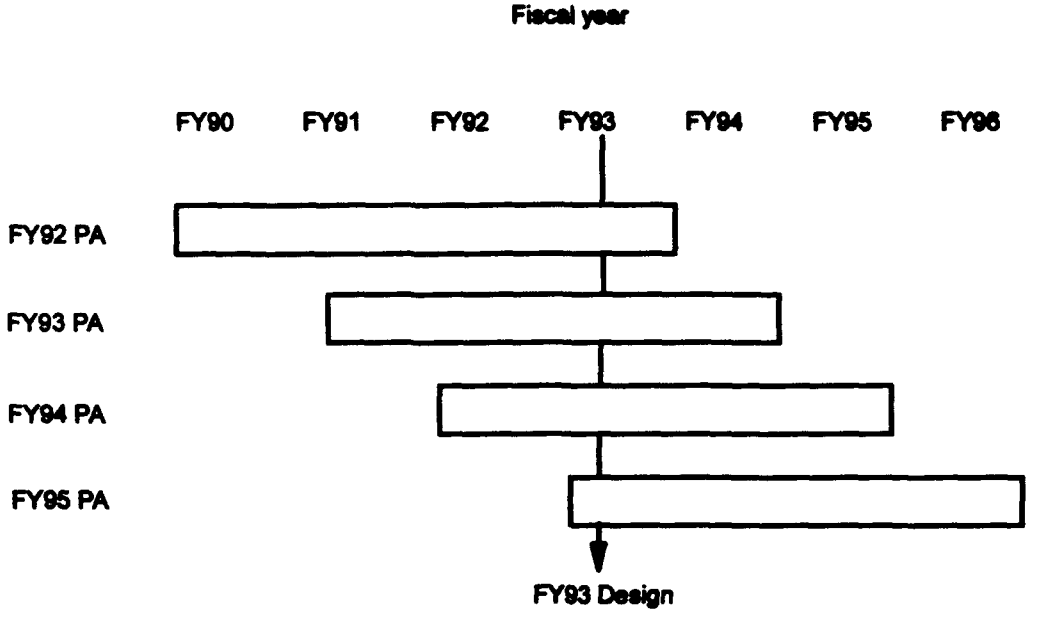


Figure A-4.
Construction Workload Spreading

The factors developed from the analysis of historical manpower use versus workload are then applied to the spread workload. Factors were developed for six major functional areas: division office staffing, district support staffing (A&A), district engineering (departmental overhead), district construction (departmental overhead), district direct engineering, and district field construction offices. Division office staffing represents the Military Construction (MILCON)-driven manpower requirement for USACE Divisions. District support staffing is the manpower needed to provide the support functions within a district such as legal, finance, and accounting services. District engineering refers to the manpower required to provide technical indirect support for the district's engineering program. District construction is the construction equivalent to district engineering (i.e., the construction departmental overhead). District direct engineering is the manpower within a district that is directly charged to engineering projects. The district field construction offices functional area refers to the manpower associated with staffing field elements such as area and resident offices. The model calculates manpower forecasts for each of these categories.

Some caution must be exercised when using the estimates of manpower requirements for any of the functional areas. The factors for each functional area

were developed from historical data, and in some cases, data were found to vary significantly among districts. Although we have a high level of confidence in the total USACE functional breakouts, extrapolating ratios of USACE functional areas to the districts implies a level of precision that does not exist in the existing manpower model. Such extrapolations should be used only as a guide and not as a suggested functional staffing level.

The model builds manpower summary tables. Those tables display the manpower requirements by fund type for each year. Summary tables are calculated for engineering manpower requirements, construction manpower requirements, and total (i.e., engineering, construction, and support) manpower requirements. Additional tables that depict dollar placement summaries by fund type are also developed.

APPENDIX B

Civilian Force Configuration and Management

Civilian Force Configuration and Management

General Description

The Civil Works Directorate uses the Civilian Force Configuration and Management (FORCON) model as a tool for developing its Civil Works manpower resource requirements and for determining full-time equivalent (FTE) workyear allocations for USACE commands. The Civil Works Directorate's first priority is to develop an accurate 5-year statement of work to be performed in each USACE district and to prepare the commander's estimate of the manpower required to execute that work on schedule. Those estimates are used to present the total Corps requirements to the Office of Management and Budget (OMB). The Directorate's second priority is to distribute the manpower allocation ceiling, set by OMB, equitably among all USACE districts.

Organizations/Functions

The FORCON software uses a system of codes for the organization's name and the functions within certain organizations to relate work with the individual. Table B-1 displays the hierarchy of the codes.

Administration

The Administration organization includes all organizations that normally charge to the Revolving Fund and whose costs are sold back to projects as overhead as well as personnel assigned to those organizations that are charged otherwise. Included are the Executive Office, Logistics Management Office, Safety, Resource Management Office, Information Management Office, Counsels, Personnel, Equal Employment Opportunity, Audit, Contracting and Procurement, and other functions providing general support.

Planning

The Planning organization includes all organizations responsible for the formulation, evaluation, coordination, and preparation of feasibility studies, continuing authority program studies, and components of preconstruction and engineering studies. This organization is also responsible for coordination of "planning" activities with other agencies as well as the formulation and

evaluation required to support research and development, construction, operation, major rehabilitation, maintenance, or other non-Corps work.

Table B-1.
Organization/Function Codes and Definitions

Organization code	Function code	Definitions
A	-	Administration
K	-	Planning
L	-	Engineering
N	-	Real Estate
Q	-	Construction
R	-	Operation & Maintenance
-	D	Operation & Maintenance
-	V	Operation & Maintenance
-	F	Operation & Maintenance
-	P	Operation & Maintenance
-	T	Operation & Maintenance
-	G	Operation & Maintenance
-	U	Operation & Maintenance
-	E	Operation & Maintenance
W	-	Research & Development
-	X	Researchers
-	Y	R&D Technical Support
Z	-	Program & Project Management

Engineering

The Engineering organization includes engineering and design activities required for planning phase studies and reports, preconstruction engineering and design, continued engineering and design activities during construction, project operations, maintenance work, and real estate activities. Other responsibilities include engineering management and performance of technical tasks associated with the major programs described above, cost engineering activities for all aspects of planning, engineering, construction, operations and maintenance (O&M) for civil works projects, management and operation of the division testing laboratories, and value engineering.

Construction

The Construction organization is responsible for all the activities for personnel involved in the supervision and administration of construction contracts,

including O&M supervision and administration, general and Mississippi River & Tributaries (MR&T), maintenance contracts, or "Public Law 99" work.

Operation and Maintenance

The O&M functions are discussed below.

Dredging. The dredging function includes administration, management, and operations related to maintenance dredging, or in direct support of maintenance dredging.

Operations-related navigation functions. Operations functions are generally related to the 601-619 features in the O&M accounts. These include site operations for navigation locks and adjacent navigation dams or control structures, and bridges, including lock operation at multi-purpose projects with power; district and division supervision; and performance monitoring system data reporting.

Maintenance-related navigation functions. The maintenance functions are generally related to the 620-635 features in the O&M appropriation. These features include drift and debris removal; snagboat operations; removal of wrecks and other obstructions; maintenance and repair of navigation structures; development, administration, and inspection of maintenance contracts for navigation-related activities on completed projects; and the prevention of obstructive and injurious deposits(that are specifically related to the responsibilities of the Supervisors of Harbor at New York, Baltimore, and Hampton Roads Harbors).

Flood Control. The flood control function is related to all activities performed by personnel in the administration and management of flood control aspects of completed projects such as reservoirs, local protection projects, and other special activities.

Hydropower Control. The hydropower control function encompasses the following activities: hydroelectric production activity for all multi-purpose projects that lead to the production of marketable electric power. This function also obtains staff for the operation, preventive maintenance, and minor emergency repair of the power plant structure and associated equipment (including the switchyard).

Natural Resources Management. The natural resources management function involves those administrative and management actions performed by personnel who manage or protect the resources of Corps Civil Works projects. Recreation, flood control, and project management are the broad categories of this function.

Regulatory Program. The regulatory program's function includes the activities of personnel directly involved in the administration of the Corps' regulatory program in accordance with regulations promulgated pursuant to the Clean

Water Act (Section 404), the River and Harbor Act (Sections 9 and 10), and the Marine Protection Research and Sanctuaries Act (Section 103).

Emergency Management. The emergency management function is responsible for all supervision, administration, policy development, implementation guidance, training, operational coordination, and publication required for the planning, execution, or exercise of response, evaluation, and corrective action for the readiness management programs of USACE.

Revetment Operations. Revetment operations are only undertaken by the Lower Mississippi Valley Division.

Research and Development

The R&D functions are identified below.

Research. This function encompasses the management and execution of research and development activities by engineers and scientists.

Technical Support. This function involves the technical support for R&D activities conducted by technicians under the auspices of engineers and scientists. Their activities include materials testing, printing, and instrumentation control.

Program and Project Management

The Program and Project Management function involves all the efforts associated with supporting the Civil Works programming process. This includes the development of annual and multi-year Civil Works programs; the submission of budget and schedule inputs to accommodate congressional budgeting requirements; the preparation of program presentations and defenses; the reception, interpretation, dissemination, and implementation of program guidance, directives, and correspondences from higher levels; the overall management of the project and supervision of staff; the development of the *Project Management Plan;* and the performance of project management requirements set by the Project Review Board, the construction partner, and higher levels of government.

INPUTS

Field Input

The Civil Works Directorate uses the FORCON model as a tool for developing its Civil Works personnel resource requirements and for determining FTE workyear allocations. The model provides the means by which USACE Commands project their workyear requirements to execute their missions. The data

base gives a 7-year view of manpower utilization and requirements from past year (PY) through budget year (BY) plus 4 years (i.e., PY=FY92 and BY+4=FY98). For the current year (CY), FORCON shows how a USACE Command allocates its funds and represents how a USACE Command allocates its funds and workyears in accordance with the U.S. President's budget. Funds and workyears are displayed by

- project,
- appropriation,
- organization/function, and/or
- method of work performance (i.e., in-house staff, contract staff, or by others).

Data Organization

Data are organized as described below.

Funding Data. The funding data record is a 7-year display of actual or anticipated project funds. The record comprises five parts: congressional budget/work allowance, carry-in funds, funds from other USACE or other governmental sources, cash contributions, and carry-out funds. Funding amounts will be read into FORCON by HQUSACE from available data sources prior to the start of each manpower cycle.

Manpower and Fund Distribution Data. On a single-year basis, the funds available to do work for a specific project are spread by organization and function. This data record is composed of five parts: FTE, hired labor, other in-house costs, contract payments (i.e., A-E, other services, and construction placement), and funds to other corps and to other governmental agencies.

The FTE and hired labor are interrelated; therefore, FORCON calculates one given the other (on the basis of average organization/function costs developed annually in each USACE Command). Total workyears for the USACE Command are constrained to the existing manpower voucher for the CY, but they represent requirements in the BY.

The CY input represents the USACE Command's plan concerning resource allocation to accomplish the mission. That input indicates to HQUSACE the location of workers by organization/function. The CY input will match the current manpower voucher at the lowest USACE Command level.

Organization and Function Data. Refer to the discussion under "Organization and Function" (above) for an explanation of the structure and definition of manpower by organization and function.

PROCESS

USACE Analysis

Corps of Engineers Civil Works-Analysis Branch (CECW-BA) reviews the manpower requirement data submitted, integrates major subordinate commands' (MSCs') data into one data base, and verifies the program amounts. Some of the original data are modified. These modifications fall into several general categories: last minute data changes, USACE program manager-dictated changes, data entry errors, missing or inappropriate subcodes, redistribution of FTE among the three major groups [i.e., MSCs, labs and separate field operating activities (FOA), and HQUSACE] by the Headquarters, Manpower Advisory Council.

Manpower Advisory Council

The Manpower (MP) Advisory Council is chaired by the Director, Civil Works. The Council has representatives from the Engineering, Planning, Project Management, Construction and Operations, and Programs Divisions of the Directorate and from the Real Estate, Research and Development, Military Programs (e.g., Environmental Restoration Support Program), and Resource Management Directorates. The Council can recommend to the Director manpower allocation changes that are necessary to carry out the Council's policy decisions.

Manpower Distribution

Up to this point, the FORCON data base contains CY data (based on known workload) and BY data (based on the President's budget program). These two developed programs are used to generate distribution rates. Those rates are used, coupled with funding estimates for the outyears (i.e., BY+1 year through BY+4 years), to generate manpower requirement trends by organization and function and to develop requirements to be presented to OMB for outyear allocations.

FORCON-Generated Distribution Rates. Once all data have been entered into the data base, distribution rates are computed for every fund category from CY and BY data input by each USACE Command. While three different levels of distribution rates may be generated (i.e., Headquarters, Division, and District), only the Headquarters level is used for the allocation of manpower. For each fund category, two rates will be developed: one for organization and function allocation and one for method of work. (See Table B-2.)

Table B-2.
FORCON Distribution Rate Table

Organization/ function rate		Method of work rate					
Org. Name	Org.	Hired labor	Other in-house	A-E & Svc. contract	Const. contract	To other corps	To other agency
ADMIN	0.03	0.46	0.32	0.02	0.00	0.19	0.00
PLNNG	0.01	0.46	0.20	0.24	0.01	0.03	0.05
ENGR	0.12	0.43	0.19	0.27	0.01	0.10	0.00
CONST	0.80	0.04	0.02	0.00	0.92	0.00	0.02
OPNS	0.00	0.77	0.23	0.00	0.00	0.00	0.00
PPM	0.02	0.58	0.28	0.02	0.04	0.08	0.00
RE	0.02	0.3	0.14	0.25	0.26	0.05	0.00

Source: The data base file, FORCTRND.DBF, from the FY93 FORCON data base.

The organization and function allocation rate is developed by dividing the total funds available for each organization and/or function within the fund category for CY and BY by the total funds available for the fund category.

The method of work rate is obtained by dividing the total funds available for each of the methods of work (i.e., hired labor, other in-house, A-E and services contract, construction contract, to other Corps, and to other agency) within a fund category by total funds available for each organization and/or function within the fund category.

FORCON-generated Manpower Requirements. Distribution rates are used with the funding amount (i.e., funds available to do the work) for each fund category, to derive manpower requirements for each organization and function. For example, the funds available are multiplied by the organization and function allocation rate to yield the amount allocated to the Engineering office. That amount then is multiplied by the method-of-work rate (i.e., the hired labor portion in the example depicted below) to give the hired labor dollars for engineering. That figure then is divided by the average cost per organization (i.e., cost and FTEs) to produce the FTE workyears required for that organization and function. Thus, manpower requirements in any year for which funding data exist may be computed for each project on the basis of the workload spread for CY and BY. Those project data are totaled for each USACE Command. The same computational method is used to track other in-house costs, contracts (i.e., A-E services and construction placement), and to other costs (i.e., Corps and agency). (See Table B-3.)

Table B-3.
Manpower Distribution Rate Table — FORCON Model Example

Organization name	Organ./function rate[a]	Method of work[b]	FORCON ave. cost $/FTE[c]	FTE
ADMIN	0.03	0.46	36	2.0
PLNG	0.01	0.46	45	0.6
ENGR	0.12	0.43	45	5.7
CONST	0.80	0.04	48	3.2
OPNS	0.00	0.77	39	0.4
PPM	0.02	0.58	45	1.5
RE	0.02	0.30	36	0.8
Total	–	–	–	14.2

[a] From Table B-2.
[b] Hired labor rate from Table B-2.
[c] Mobile District average cost from FY93 data base.

Manpower Advisory Council Figures. The next step in the manpower distribution process is incorporating manpower initiatives directed by the HQ Manpower Advisory Council. For example, in FY93, two initiatives were started. For the first initiative, the percentage of administrative staff compared with total staff measured at MSC in FTE will be reduced. For the second initiative, the percentage of the organization's funds used for A-E service contracts for the Planning and Engineering Offices will increase (as measured at the MSC in funds for each of the organizations). Thus, in the first case, the ratio of hired labor and other in-house costs was modified for each year, progressively reducing the percentage that was allocated to administer labor, while similarly increasing the percentage allocated to administer other in-house costs. In the second case, the percentage of A-E service for the Planning and Engineering offices was increased, while the percentage for hired labor and other in-house costs was correspondingly reduced.

Constrained Allocation. Another part of the allocation process involves constraints placed on manpower by Congress. Each year, Congress adds studies and construction projects that were not in the President's budget or it increases/decreases the budget amounts. Generally, these are paid for from available funds by reducing all studies and construction projects (through increases in assumed savings and slippage). In anticipation of this action, manpower is withdrawn from that available for distribution.

New Construction Starts. Although the allocation process does not explicitly address the outyears, the President's budget does have assumed ceilings. Without integrating new construction starts into the allocation process, the Corps' future construction program would taper off in the outyears. The Program Division data base is the source of information about which projects and funding amounts should be assumed for the integration of new starts. This

information is entered into a separate data base and the model is run to obtain the future manpower requirements.

Recommended Manpower Allocation. The recommended manpower allocation, based upon that generated by the FORCON model, is then given to the Director, Civil Works, for distribution to USACE Commands. If that total exceeds the OMB manpower ceiling, then the calculated manpower is reduced to fit the ceiling. The constrained manpower allocation, along with the new starts data is the basis for this final step. Long-term workload trends are used to mitigate modeled requirements of increases or decreases for the budget year manpower allocation.

OUTPUTS

Several reports are generated by the FORCON model. Descriptions of those reports and sample page layouts are discussed below.

Project Funding Report

The Project Funding Report is a single-year report for a chosen fiscal year. The data are sorted by Engineering Report Organization Code (EROC) and by project on the basis of the Civil Works Information System (CWIS) number. Within each project, the data are sorted by appropriation code. Only those items that appear in the data base for a given year will be listed under each project. Figure B-1 is a sample project funding report. The first column in the report is the appropriation code (i.e., App.). The second column refers to the budget or appropriation amount. The third column is the amount of unexpended funds carryover from previous fiscal years. The fourth and fifth columns are the amount received "from" other Corps entities and the amount received from other Federal agencies, respectively. Column six is the required cash contributions received from local interests or others. Column seven is the amount of funds that are not expected to be expended in the fiscal year in question. Column eight is the difference between the sum of columns three through six and column eight. Column nine is . . .

10/22/92 09:20 Page: 12 PROJECT FUNDING ($000)

Place Optional Title Here

LI (SPL) Reporting Year: 93

App.	Budget/ Work Allow.	Carry In	From Corps	Other Agency	Source Cash	Gross Total	Carry Out	Funds Avail.
CORPS STATUTORY AUTHORITY (CWIS 00120-A , PRISM DA010-)								
D	216	0	0	0	0	216	0	216
TOTAL	216	0	0	0	0	216	0	216
FCCE, ACTIVITIES IN SUPPORT OF OTHERS (CWIS 00120-B , PRISM DA020)								
D	67	0	0	0	0	67	0	67
TOTAL	67	0	0	0	0	0	0	67
FACILITIES (CWIS 00120-C , PRISM DA030-)								
D	45	0	0	0	0	45	0	45
TOTAL	45	0	0	0	0	45	0	45
DISASTER PREPAREDNESS (CWIS 00120-D , PRISM DA040-)								
D	100	0	0	0	0	100	0	100
TOTAL	100	0	0	0	0	100	0	100
PERMIT EVALUATION (CWIS 08204 , PRISM FE100-)								
D	1,037	0	0	0	0	1,037	0	1,037
TOTAL	1,037	0	0	0	0	1,037	0	1,037
ENFORCEMENT (CWIS 08205 , PRISM FE200-)								
FE	441	0	0	0	0	441	0	441
TOTAL	441	0	0	0	0	441	0	441
GENERAL REGULATORY FUNCTIONS - EIS (CWIS 88870 , PRISM FE500-)								
FE	98	0	0	0	0	98	0	98
TOTAL	98	0	0	0	0	98	0	98
STUDIES (CWIS 88890, PRISM FE300-)								
FE	196	0	0	0	0	196	0	196
TOTAL	196	0	0	0	0	196	0	196
Total by Appropriation Code for L1 (SPL)								
D: F.C. & Coast Emergencies	428	0	0	0	0	428	0	428
FE: Gen Regulatory Funct								
SPL	1,772	0	0	0	0	1,772	0	1,772
TOTAL	2,200	0	0	0	0	2,200	0	2,200

Figure B-1.
Sample Project Funding Report

Project Organization Report

The Project Organization Report is a single-year report that is sorted by EROC and CWIS (project) number. Within each project, the data are further sorted by organization code and, where applicable, by function code. In the sample report depicted in Figure B-2, only one EROC and one project are represented. The column headings for this report are the same as those in the Project Funding Report, except for the indented subheadings, which relate to the funding requirements by organizational function. The column one heading is "Organization Function Code" and refers to the organization code. The column two heading is "FTE Workyears," which represents the full-time equivalent work years for that year. Columns three and four are in-house labor and in-house other costs, respectively. Column five, entitled "AE Services," refers to all service-type contracts, including architecture and engineering contract payments. Column six represents construction placement payments. Columns seven and eight represent the amount of funding "given to" other USACE entities and other Federal agencies, respectively. The "FUNDS AVAIL" line of the report contains data carried in from the funding data base file.

Organization Summary Report

The Organization Summary Report is a single-year report for a chosen fiscal year. Figure B-3 is a sample Organization Summary Report. The report summarizes the project organization data associated with all projects within each EROC. The data are sorted by EROC and then by organization code. The values for each organization code are the sum for that code of all the projects within the EROC. The data for each organization code are further sub-divided according to function.

Funding Summary Report

The Funding Summary Report is a single-year report for a chosen fiscal year. Figure B-4 is a sample Funding Summary Report. This report shows funding data totals from the funding file by appropriation and category. Appropriation and grand totals are shown. A total is also displayed for a given EROC.

Category Summary Report

The Category Summary Report is a single-year report for a chosen fiscal year. Figure B-5 is a sample Category Summary Report. This report shows funding data totals from the organization file by appropriation and category. The report shows totals by appropriation as well as for the entire division or Corps if applicable.

10/22/92 09:21 Page: 2 PROJECT ORGANIZATION ($000)

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FORCON DATA REPORTING YEAR: 93

EROC LO (CWIS 04850 SOUTH PACIFIC DIV. GENERAL EXPENSE EA 120)

Ap-CCS-S	Yr.	Budget/ Work Allow.	Carry In	From Corps	Other Agency	Cash	Gross Total	Carry Out	Funds Avail.
E-120-	93	8,391	0	0	0	0	8,391	0	8,391

Org. Func Code	FTE Wrkyrs.	Hired Labor	Contract-Payments Other In-House	AE Srvcs.	Cnst Plc.	To Other Corps	To Other Agency	Fund Category Totals
ADM	40.2	1763.5	489.5	0	0	574	5	2832.0
PLN	15.0	1007.0	369.5	0	0	13	0	1389.5
ENG	19.0	1220.8	409.6	0	0	0	0	1630.4
RE	4.3	252.1	76.0	0	0	0	0	328.1
CNT	3.7	264.2	123.5	0	0	0	0	387.7
OPS	8.6	522.4	177.5	0	0	0	0	699.9
FC	1.9	90.8	34.8	0	0	0	0	125.6
NRM	2.2	116.6	33.7	0	0	0	0	150.3
EM	1.4	74.3	44.6	0	0	0	0	118.9
NAV	3.1	240.7	64.4	0	0	0	0	305.1
PPM	12.2	785.6	338.0	0	0	0	0	1123.6
TOTAL	103.0	5815.6	1983.6	0	0	587	5	8391.2

FUNDS AVAIL = 8391.0
DIFFERENCE = -0.2

EROC LO (CWIS 08204 GENERAL REGULATORY - PERMIT EVALUATION)

Ap-CCS-S	Y.r.	Budget/ Work Allow.	Carry In	From Corps	Other Agency	Cash	Gross Total	Carry Out	Funds Avail.
E-120-	93	205	0	0	0	0	205	0	205

Org. Func Code	FTE Wrkyr.s.	Hired Labor	Contract-Payments Other In-House	AE Srvcs.	Cnst Plc.	To Other Corps	To Other Agency	Fund Category Totals
ADM	0.4	15.9	10.7	1	0	7	0	34.6
OPS	1.4	115.0	47.4	4	1	1	2	170.4
GRF	1.4	115.0	47.4	4	1	1	2	170.4
TOTAL	1.8	130.9	58.1	5	1	8	2	205.0

FUNDS AVAIL = 205.0
DIFFERENCE = 0.0

Figure B-2.
Sample Project Organization Report

10/22/92 10:01 Page: 69 ORGANIZATION SUMMARY ($000))

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H0 (ORD) REPORTING YEAR: 93

Org. Func Code	FTE Wrkyrs	Hired Labor	Contract-Payments: Other In_House	Contract-Payments: AE Srvcs.	Contract-Payments: Cnst Plc.	To Other Corps	To Other Agency	Fund Category Totals
ADM	125.1	1738.8	1752.0	42	0	755	6	7286.6
PLN	19.4	1227.6	447.1	2	0	16	0	1692.7
ENG	40.2	2461.7	1060.6	48	0	111	5	3686.3
RE	4.3	290.6	87.6	8	0	0	0	370.2
CNT	3.8	304.4	142.4	8	0	0	0	446.0
OPS	15.6	1157.0	499.3	26	2	7	1	1692.3
GRF	1.3	95.3	40.0	4	1	0	1	141.3
NRM	2.3	163.7	47.4	8	0	0	0	211.1
EM	7.9	560.0	321.4	22	1	7	0	911.4
NAV	4.1	338.0	90.5	8	0	8	0	428.5
PPM	14.3	1011.2	414.9	1	0	4	0	1431.1
TOTAL	222.7	11183.3	4404.7	119	2	893	12	16614.2

Figure B-3.
Sample Organization Summary Report

10/22/92 10:31 Page: 1 FUNDING SUMMARY

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B0 (LMV) Reporting Year: 93

App. CCS	Budget/ Work Allowance	Carry In	From Corps	Other Agency	Source Cash	Gross Total	Carry Out	Funds Avail.
A 100	83	0	0	0	0	83	0	83
A 200	195	0	0	0	0	195	0	195
B 200	23	0	0	0	0	23	0	23
BZ A00	0	0	0	0	0	0	0	0
BZ B00	0	0	0	50	0	50	0	50
C 500	110	0	0	0	0	110	0	110
D 100	192	0	0	0	0	192	0	192
D 600	4	0	0	0	0	4	0	4
E 100	9,342	0	0	0	0	9,342	0	93,42
FE 100	238	0	0	0	0	238	0	238
WC	8	0	11,298	0	0	11,298	0	11,298
LMV TOTAL	18,187	0	11,298	50	0	21,535	0	21,535

Figure B-4.
Sample Funding Summary Report

10/22/92 11:00 Page: 1 CATEGORY SUMMARY ($000)

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LO (SPD) Reporting Year: 93

App Code	FTE Wrkyrs	Hired Labor	Other In-House	Contract Payments: AE Srvcs	Contract Payments: Cnst Plc	To Other Corps	To Other Agency	Fund Category Totals
Total by Appropriation Code for LO (SPD)								
A 100	0.2	8.4	8.6	0	0	4	0	21.0
A 200	3.1	192.0	84.0	11	0	15	0	302.0
BZ A00	0.8	52.4	33.6	19	70	3	0	178.0
BZ B00	1.3	72.9	14.1	7	0	2	0	96.0
C 500	2.6	142.7	77.3	7	0	3	0	230.0
D 100	16.4	867.8	606.2	37	0	47	2	1560.0
E 100	103.0	5815.9	2009.3	2	0	587	5	8419.2
FE 100	1.8	130.9	58.1	5	1	8	2	205.0
WC	68.5	3036.4	3115.6	125	2	265	33	6577.0
SPD TOTAL	197.7	10319.4	6006.8	213	73	934	42	17588.2

Figure B-5.
Sample Category Summary Report

Detailed Category Report

The Detailed Category Report is a single-year report for a chosen fiscal year. Figure B-6 is a sample of the Detailed Category Report. This report shows funding data totals by appropriation and detailed category, as well as by project ID number as a user-provided parameter.

Quick Project List Report

The Quick Project List Report provides the user with a list of projects, sorted by EROC and CWIS number. Figure B-7 shows a sample of the Quick Project List Report. The report can reflect an EROC specified by the user, by an entire division, or for the entire data base.

Quick To/From List Report

The Quick To/From List Report lists all To/From field data. Figure B-8 shows a sample Quick To/From List report. One report line will be displayed for each record in the To/From field data file for the requested EROCs. The data will be sorted by EROC, CWIS, interim CWIS, appropriation code, category/class/subclass, and year.

10/22/92 11:02 Page: 1 DETAILED CATEGORY)

Place Optional Title Here

AO (HNT) Reporting Year: 93

App. Code		FTE Wrkyrs.	Hired Labor	Other In-House	Contract-Payments to Other: AE Srvcs.	Cnst Plc.	Corps	To Other Agency	Fund Category Totals
A	140 Special Studies								
		1.7	75.3	73.7	7	0	111	0	267.0
A	14 Special Studies (Class Total)								
		1.7	75.3	73.7	7	0	111	0	267.0
A	1 Surveys (Category Total)								
		1.7	75.3	73.7	7	0	111	0	267.0
A	382 Magnetic Levitation								
		10.7	530.3	1715.7	6371	0	1575	1638	11830.0
A	38 Technology Transfer Program (Class Total)								
		10.7	530.3	1715.7	6371	0	1575	1638	11830.0
A	3 Research and Development (Category Total)								
		10.7	530.3	1715.7	6371	0	1575	1638	11830.0
A	General Investigations (Appropriation Total)								
		12.4	605.6	1789.4	6378	0	1686	1638	12097.0
SUB TOTAL		12.4	605.6	1789.4	6378	0	1686	1638	12097.0
B	70 Miscellaneous								
		15.6	653.3	414.7	315	0	1422	0	2805.0
B	70 Miscellaneous (Class Total)								
		15.6	653.3	414.7	315	0	1422	0	2805.0
B	7 Miscellaneous (Category Total)								
		15.6	653.3	414.7	315	0	1422	0	2805.0
B	Construction, General (Appropriation Total)								
		15.6	653.3	414.7	315	0	1422	0	2805.0
SUB TOTAL		15.6	653.3	414.7	315	0	1422	0	2805.0
BZ	B12 HQUSACE already in B11								
		1.1	45.9	13.1	15	0	2	0	76.0
BZ	B1 Management and Support Activity (Class Total)								
		1.1	45.9	13.1	15	0	2	0	76.0
BZ	B EPA Superfund TFA72 Program (Category Total)								
		1.1	45.9	13.1	15	0	2	0	76.0
BZ	Environmental Restoration Support (Appropriation Total)								
		1.1	45.9	13.1	15	0	2	0	76.0
SUB TOTAL		1.1	45.9	13.1	15	0	2	0	76.0
E	140 Training, ED&M - Division Offices								
		0.0	0.4	29.6	3	0	0	0	33.0
E	14 Training, ED&M - Division Offices (Class Total)								
		0.0	0.4	29.6	3	0	0	0	33.0
E	1 Executive Direction and Management (Category Total)								
		0.0	0.4	29.6	3	0	0	0	33.0
E	General Expenses (Appropriation Total)								
		0.0	0.4	29.6	3	0	0	0	33.0
SUB TOTAL		0.0	0.4	29.6	3	0	0	0	33.0

Figure B-6.
Sample Detailed Category Report

10/22/92 11:05 Page: 1 QUICK PROJECT LIST

Place Optional Title Here

EROC	CWIS Number	PRISM Number	Project Name	Remarks
LO	0000		DIVISION SUPPORT TO DISTRICTS	INCLUDES TOTALS FROM A
LO	0000-A		division support to districts	added by cecw-be
LO	04850	EA120	SOUTH PACIFIC DIV. GENERAL EXP	DIVISION OFFICE
LO	06204	FE101	GENERAL REGULATORY - PERMIT EU	
LO	14800	AA436	SPD PLANNING ASSIST TO STATES	
LO	17279	EA140	SPD TRAINING, EXECUTIVE MANAGE	
LO	53904	AA431	NORTH AMERICAN WATERFOWL MANAG	
LO	5EA00	BZ716	SUPERFUND MANAGEMENT - DIVIS	
LO	82010	AB561	SPD FLOOD PLAIN MANAGEMENT SUC	
LO	82011	AB562	FLOOD PLAIN MANAGEMENT- SPECI	
LO	82025	AB400	NATIONAL FLOOD PROOFING COMMIT	
LO	84231-A	DA011	SPD CORPS STATUTORY ACTIVITIES	
LO	84231-B	DA012	ACTIVITIES IN SUPPORT OF OTHER	INCLUDES EARTHQUAKE OF
LO	84231-C	DA013	FACILITIES	
LO	84231-D	DA014	SPD INSPECTONS	FC&CE
LO	84991	CE251	MOBILIZATION PREPAREDNESS	

Figure B-7.
Sample Quick To/From List Report

10/22/92 11:08 Page: 28 QUICK TO/FROM LIST

Place Optional Title Here

APP/CCS	Yr.	Agency Code	Corps?	To/From Payment ?	Amount	
PROJ NAME: APPROP REIMB ACTIVITY						
EROC B2 CWIS 00000			(Cont.)			
						LMN-DC/PO/AE
WC-XXX	93	SWF	C	F	0.0	
WC-XXX	93	DOD	N	T	125.0	
WC-XXX	93	EPA	N	T	2.0	
WC-XXX	93	GSA	N	T	130.0	
WC-XXX	93	LA	N	T	56.0	
EROC B2 CWIS 00062						
PROJ NAME: GULF INTRACOASTAL WATERWAY, LA & TX SEC						
						LMN-OD
C-111-U	93	LMV	C	T	41.0	
C-111-U	93	NPP	C	T	20.0	
C-111-U	93	NOA	N	T	3.0	
C-111-U	93	USG	N	T	22.0	
C-111-U	93	CRL	C	T	4.0	
C-111-U	93	HEC	C	T	1.0	

Figure B-8.
Sample Quick To/From List Report

Funding/Organization Imbalance Report

The purpose of the Funding/Organization Imbalance Report is to list imbalanced records depending on the rate of selectivity. This report totals the amount allocated in all organization and function records for an associated funding record, then compares those totals with the funds available from the funding record. If the difference is above or below the user-entered selectivity rate (the percentage of difference between the total amount of funds in the funding record as opposed to the total of the amounts allocated across the associated organization and function records), then the percent difference is displayed. This is intended to be an aid for the user to quickly scan and identify funding records that have not had the money spread across their organization and function records properly. Figure B-9 shows a sample Funding/Organization Imbalance Report.

10/28/92 14:02 Page: 1 FUNDING/ORGANIZATION IMBALANCE ($000)

Place Optional Title Here

EROC	CWIS	APP	CCS	Yr.	Funding$	Organ. $	$ Diff.	% Diff.
B0	01004	FE	100	93	0.0	238.0	238.0	N/A
B0	04850	E	128-2	93	5,000.0	9,328.1	4,328.1	86.6
B0	17250	A	171	93	70.0	73.0	3.0	4.3
B0	17270	E	140	93	12.0	1.0	2.0	16.7
B0	53904	A	176	93	9.0	10.0	1.0	11.1
B0	76150	B	228-M	93	20.0	23.0	3.8	15.8
B0	82810	A	250	93	25.0	36.0	11.0	44.0
B0	82811	A	250	93	145.0	159.0	14.0	9.7
B0	84230	D	110	93	60.0	65.0	5.0	8.3
B0	84230-2	D	120	93	100.0	110.0	10.0	10.0
B0	84230-3	D	130	93	14.0	15.0	1.0	7.1
TOTAL					5,455.0	10,071.1	4,616.1	84.6%

Figure B-9.
Sample Funding/Organization Imbalance Report - 1 Percent Difference

Individuai Organization Summary Report

The Individual Organization Summary report is a single-year report for a chosen fiscal year. Figure B-10 is a sample of the Industrial Organization Summary report. This report summarizes all dollars and FTE workyears for a particular organization code. It is sorted by EROC code and program ID number. This report is identical to the Project Organization Report with the exception that it has two additional columns: "AE %" and "% of Total Program." Below are their formulae:

10/27/92 15:39 Page: 5 INDIVIDUAL ORGANIZATION REPORT - SUMMARY ($000)

Administration

B0 (LMV) Reporting Year: 93 Place Optional Title Here

Appn. Name	FTE Wrkyrs.	Hired Labor	Other In-House	Contract-Payments AE Srvcs.	Cnst Plc.	To Other Corps	To Other Agency	Organ. $
ERSB	0.1	3.6	1.4	1.0	0.0	0.0	0.0	6.0
	AE %: 16.67			% of Total Program: 12.00				
GE	40.0	2337.0	230.0	9.0	641.0	324.0	0.0	3541.0
	AE %: 0.35			% of Total Program: 37.91				
WC	59.6	2903.3	1669.1	385.0	0.0	643.0	0.0	5600.4
	AE %: 7.7			% of Total Program: 49.57				
D0 Totals	107.7	5243.9	1901.3	395.0	641.0	967.0	0.0	9148.2
	AE %: 5.24			% of Total Program: 44.22				

Figure B-10.
Sample Individual Organization Summary Report

AE% = AE services dollar value % (Organ. $ - (constr. plcmt. + payments to other corps + payments to other agencies)

% of total program = organ. $/(available funds from funding data base)

A summary by division and for the entire Corps is included.

Individual Organization Report — Detail

The Individual Organization Report — Detail is identical to the Individual Organization Summary Report with the exception that this report includes the project ID (CWIS number) and program names that comprise each program group. A sample Individual Organization Detail Report is shown in Figure B-11.

10/27/92 15:42 Page: 30 Individual Organization Report - Detail ($000)

Administration (Sorted by Project Name)

B1 (LMM) Reporting Year: 93 Place Optional Title Here

Appn. Name	FTE Wrkyrs.	Hired Labor	Other In-House	Contract-Payments AE Srvcs.	Contract-Payments Cnst Plc.	To Other Corps	To Other Agency	Organ. $
Regulatory Program:								
ENFORCEMENT (FE201)								
	0.4	14.2	11.3	1.0	0.0	6.0	0.0	32.5
NAVIGATION REGULATIONS (FE401)								
	0.1	3.6	2.4	0.0	0.0	1.0	0.0	7.0
PERMIT EVALUATION (FE101)								
	1.4	51.4	35.2	2.0	0.0	22.0	1.0	111.6
REGULATORY STUDIES (FE301)								
	0.0	1.6	1.3	0.0	0.0	1.0	0.0	3.9
REG Totals	1.9	70.0	50.2	3.0	0.0	30.0	1.0	155.0

AE %: 2.42 % of Total Program: 16.63

Figure B-11.
Sample Individual Detail Organization Report

FORCON CONTEXT DIAGRAM

Figure B-12 depicts the top-level data flow diagram describing the inputs, controls, outputs, and mechanisms that comprise the FORCON system. The field inputs and Manpower (MP) Advisory Council inputs feed into the primary process, which generates two primary outputs: CW manpower resource requirements and the final FTE allocation. Congressional action and Office of Management and Budget (OMB) ceilings represent controls that place constraints on the system. The three primary mechanisms or entities involved in the process are field staff, Headquarters personnel, and the FORCON data base (which acts as a repository of current, past, and future resource requirement data).

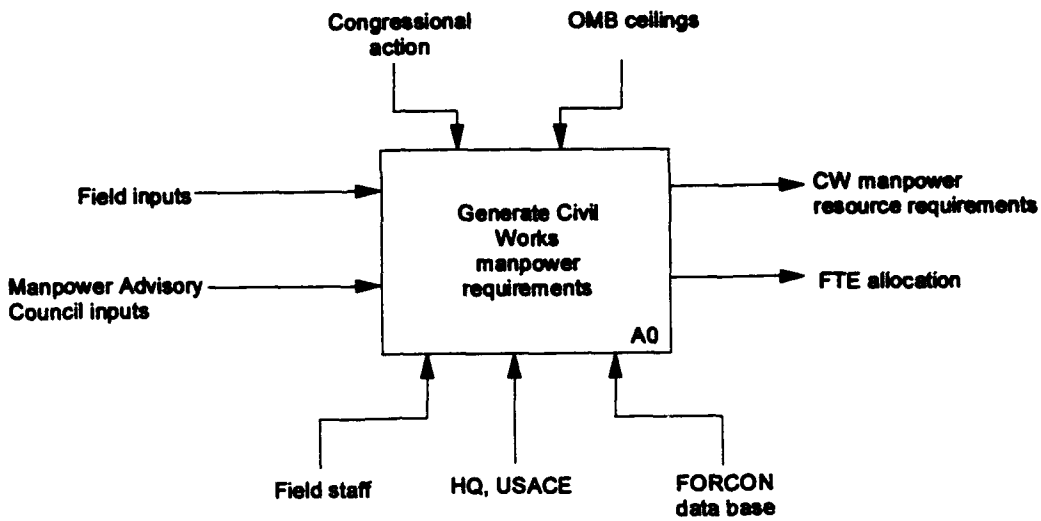


Figure B-12.
FORCON Context Diagram

APPENDIX C

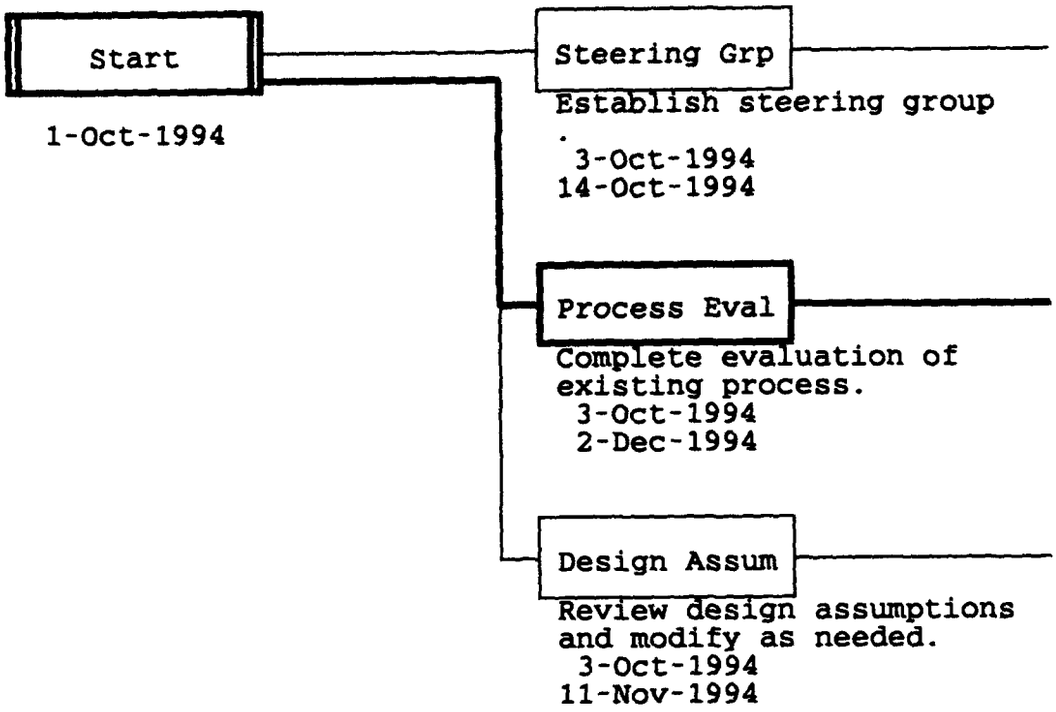
Preliminary Schedule

Preliminary Schedule

The following is the preliminary schedule for implementation of the Corps of Engineers Manpower Information System.

Task name	Description	Start date	Finish date
Start		1-Oct-1994	3-Oct-1994
Process Eval	Complete evaluation of existing process.	3-Oct-1994	2-Dec-1994
Steering Grp	Establish steering group.	3-Oct-1994	14-Oct-1994
Design Assum	Review design assumptions and modify as needed.	3-Oct-1994	11-Nov-1994
Process Chng	Identify needed process changes.	5-Dec-1994	16-Dec-1994
PROCESS CHNG	Steering group decision on process changes.	16-Dec-1994	19-Dec-1994
Data Struct	Finalize data structure.	19-Dec-1994	6-Jan-1995
Data Diction	Finalize data dictionary.	9-Jan-1995	20-Jan-1995
DATA STRUCT.	Steering group decision on final configuration.	20-Jan-1995	23-Jan-1995
Revise Code	Revise manpower code as necessary.	23-Jan-1995	7-Jul-1995
Devel. Trng.	Develop training modules.	23-Jan-1995	12-May-1995
District Pro	Develop new Dist./Div. manpower process.	23-Jan-1995	26-May-1995
Software	Purchase any necessary software.	23-Jan-1995	17-Mar-1995
Data Shell	Create database shells.	23-Jan-1995	3-Feb-1995
User Docum.	Draft user documentation.	23-Jan-1995	14-Apr-1995
Populate DBS	Populate developmental database.	6-Feb-1995	17-Feb-1995
EIS Interfac	Develop EIS interface.	20-Feb-1995	17-Mar-1995
Consol. Rpt.	Develop consolidated reports.	20-Mar-1995	28-Apr-1995
Coord. Trng.	Conduct training for manpower coordinators.	15-May-1995	7-Jul-1995
Procedures	Document new process and staff.	29-May-1995	23-Jun-1995
Final Proced	Finalize new manpower management process.	26-Jun-1995	21-Jul-1995
Test Code	Test revised code.	10-Jul-1995	4-Aug-1995

Task name	Description	Start date	Finish date
Decision Spt	Develop decision support/ forecasting capability.	7-Aug-1995	29-Sep-1995
GIS Cap.	Develop GIS capability / linkages.	2-Oct-1995	10-Nov-1995
GUI	Finalize graphical user interface.	13-Nov-1995	1-Dec-1995
Protype test	Test prototypes at two districts and HQ.	4-Dec-1995	26-Jan-1996
Revise Doc.	Revise user documentation.	29-Jan-1996	23-Feb-1996
Revise Proto	Revise protype as required.	29-Jan-1996	23-Feb-1996
FIELD SYSTEM	Field system.	23-Feb-1996	26-Feb-1996
Tech. Supt.	Technical support for new system.	26-Feb-1996	14-Jun-1996
End		14-Jun-1996	14-Jun-1996


Start
1-Oct-1994
Steering Grp
Establish steering group
.
3-Oct-1994
14-Oct-1994
Process Eval
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existing process.
3-Oct-1994
2-Dec-1994
Design Assum
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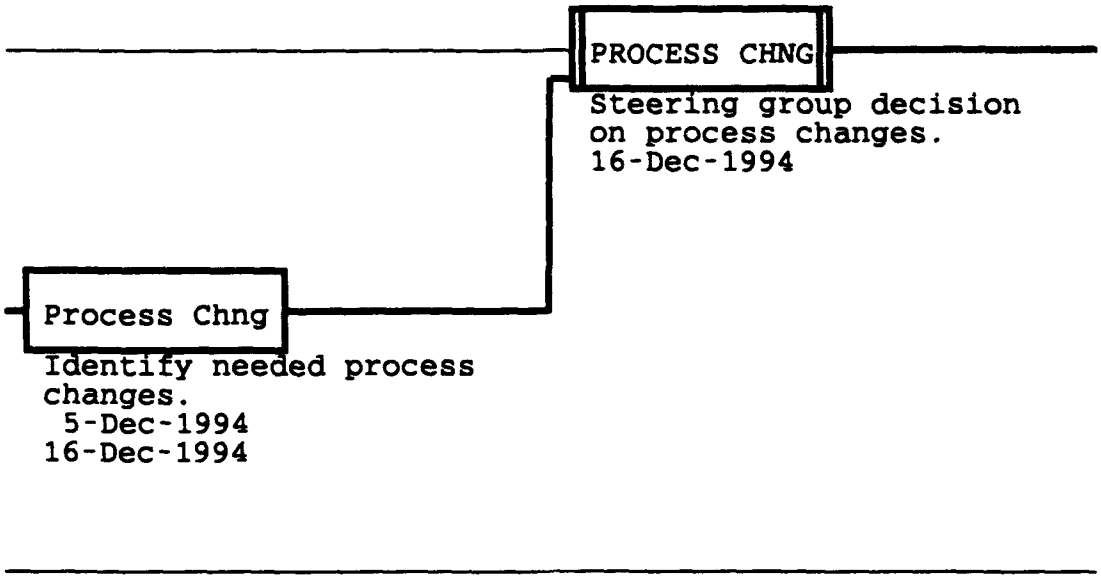
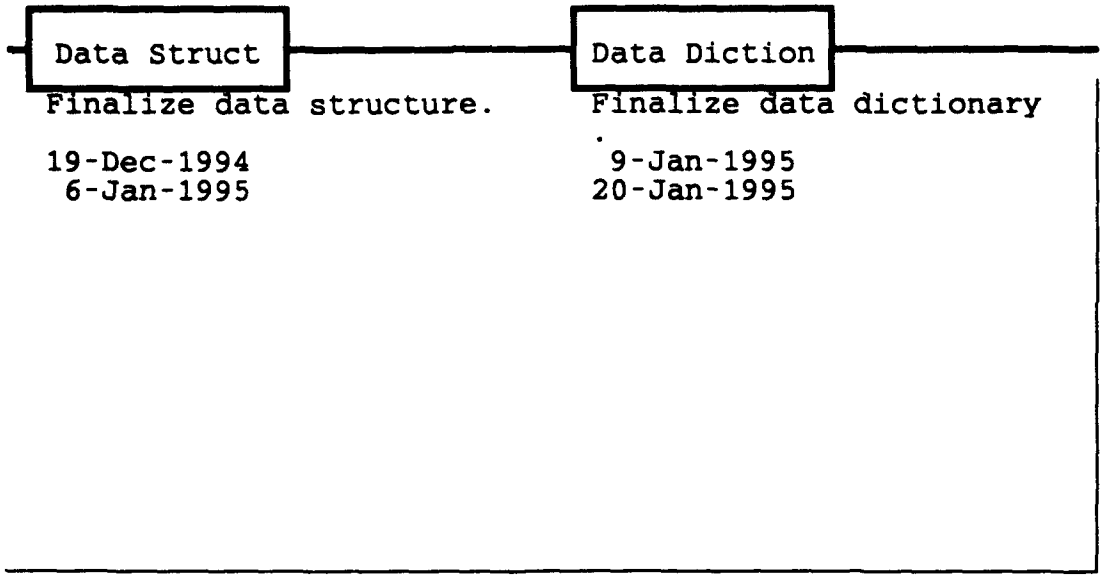
and modify as needed.
3-Oct-1994
11-Nov-1994


PROCESS CHNG
Steering group decision on process changes.
16-Dec-1994
Process Chng
Identify needed process changes.
5-Dec-1994
16-Dec-1994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6-Jan-1995
Data Diction
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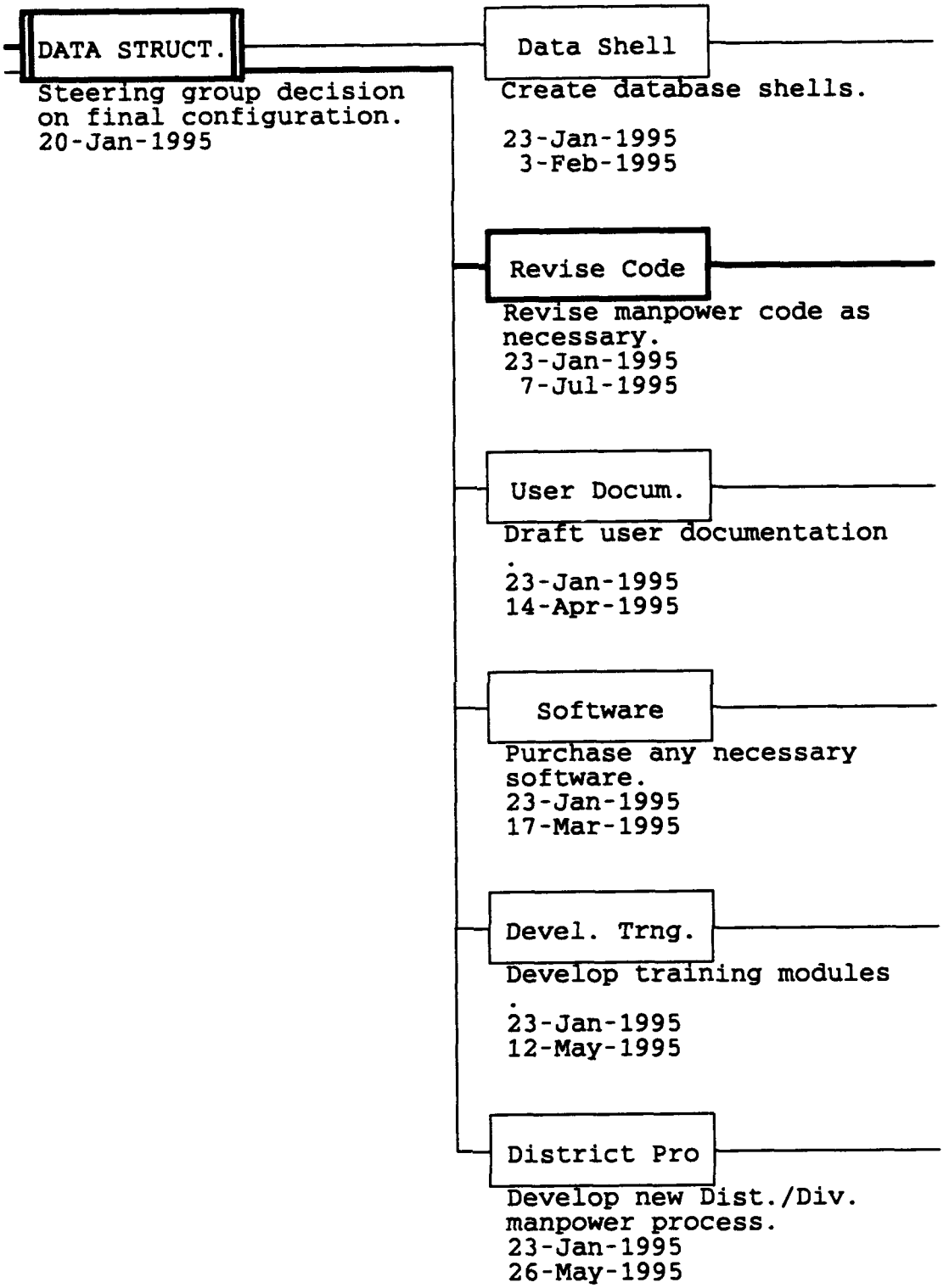
9-Jan-1995
20-Jan-1995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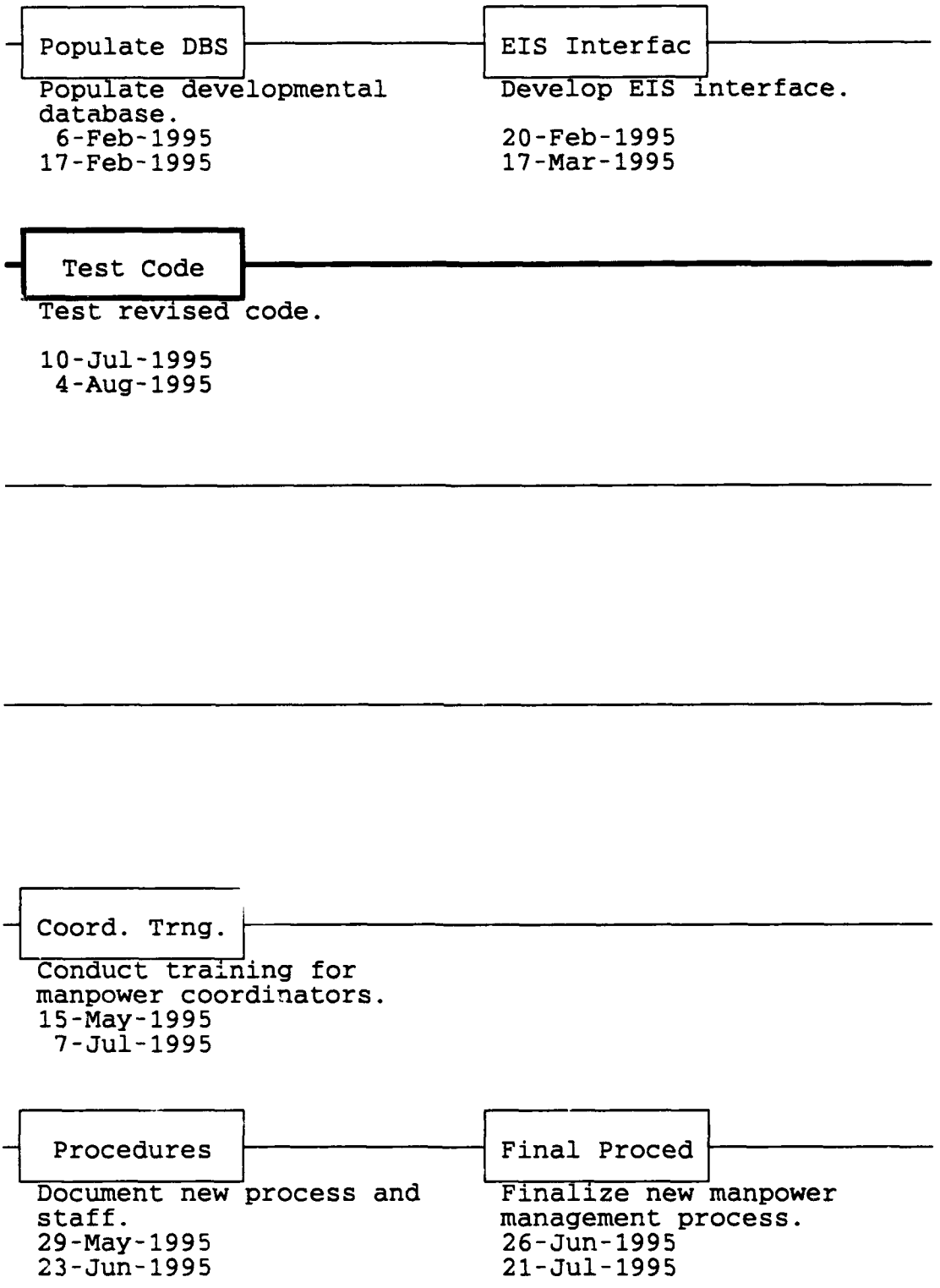
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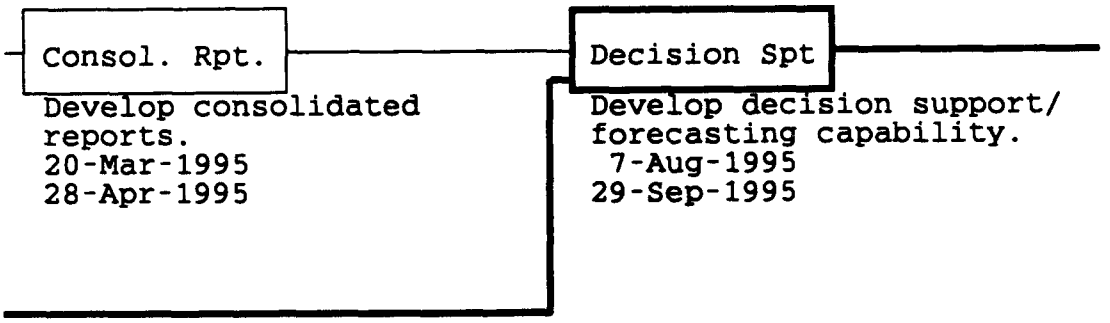
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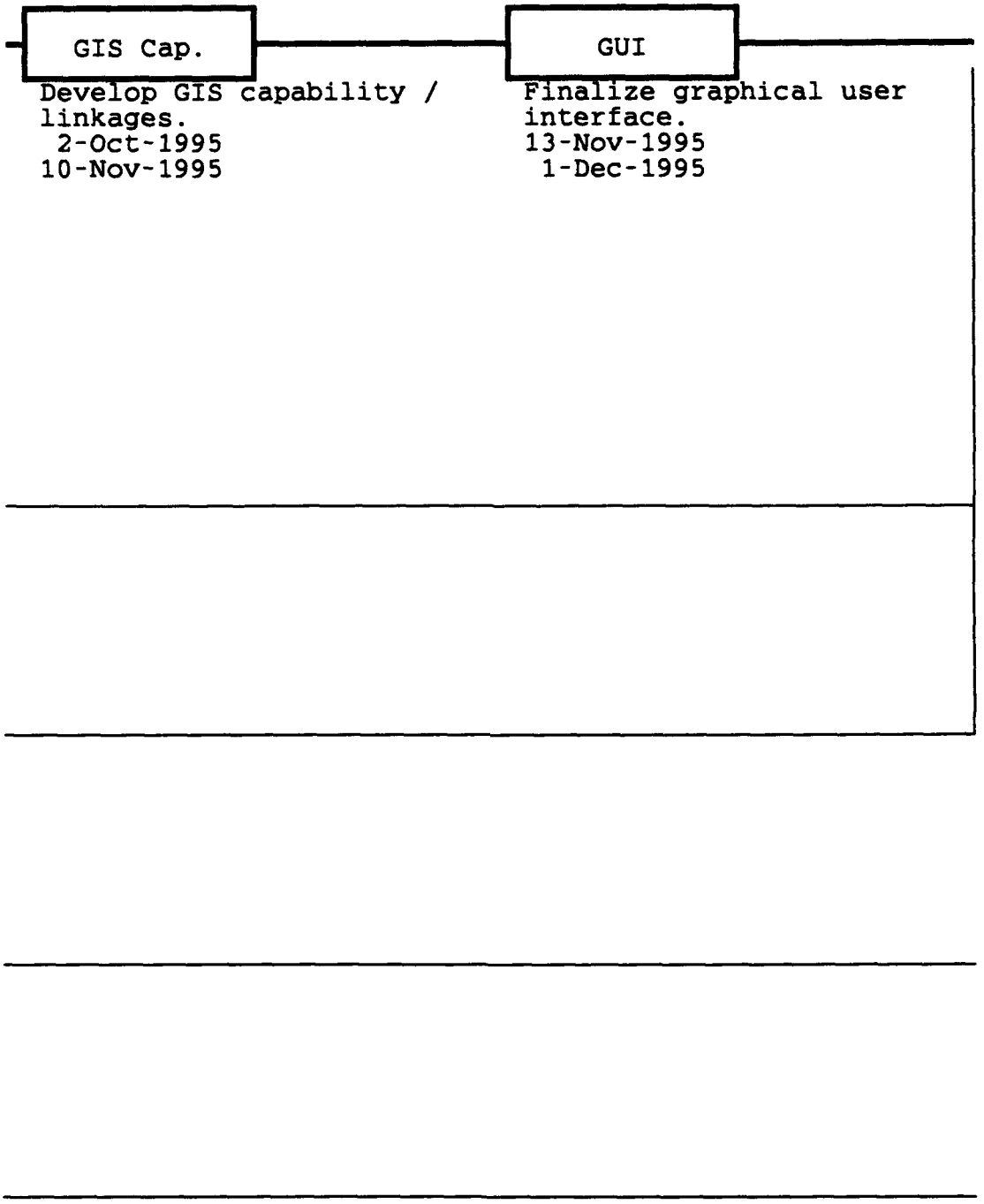
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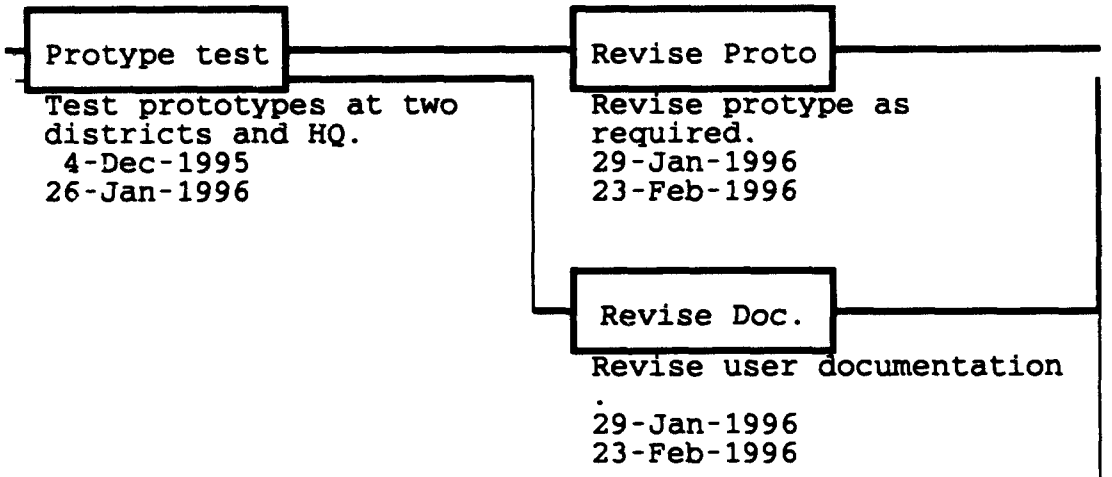
Protype test
Test prototypes at two districts and HQ.
4-Dec-1995
26-Jan-1996
Revise Proto
Revise protype as required.
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Revise Doc.
Revise user documentation
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29-Jan-1996
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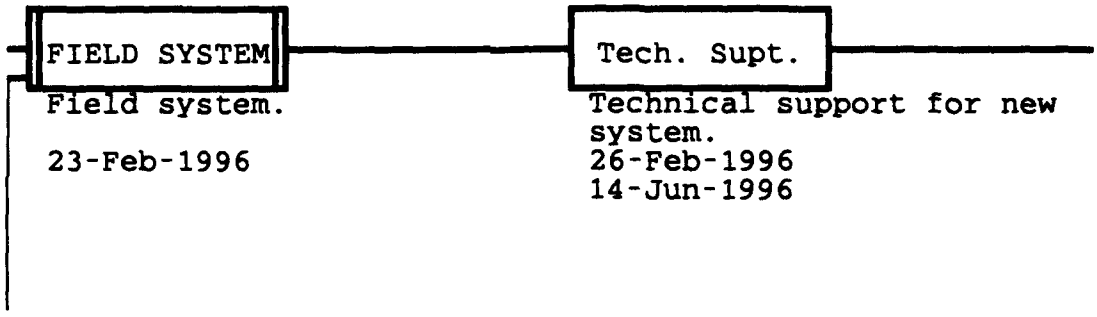

Field system.

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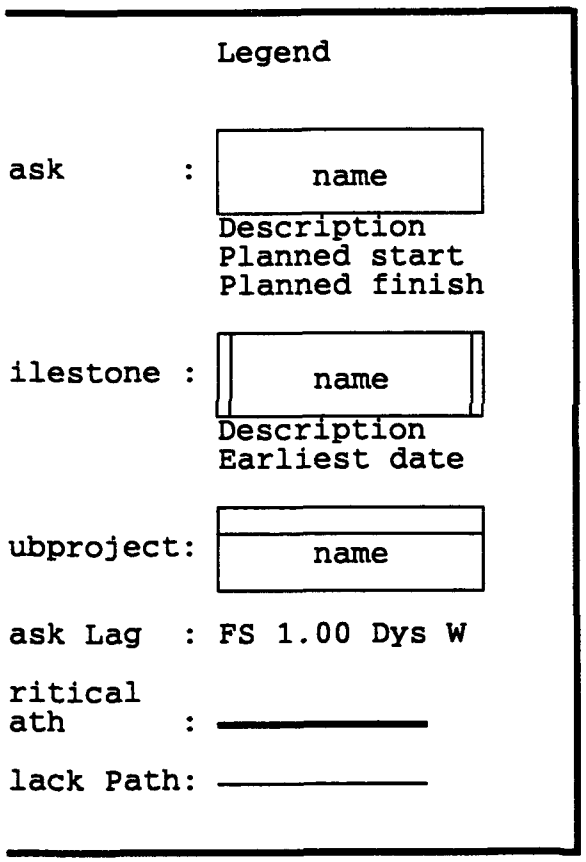
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REPORT DOCUMENTATION PAGE

Form Approved
OPM No.0704-0188

1. AGENCY USE ONLY *(Leave Blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	April 1994	Final

4. TITLE AND SUBTITLE

U.S. Army Corps of Engineers Manpower Information System: An Integrated Approach to Manpower Management

5. FUNDING NUMBERS

C DACW31-90-D-0076

PE 0902198D

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Logistics Management Institute
6400 Goldsboro Road
Bethesda, MD 20817-5886

8. PERFORMING ORGANIZATION REPORT NUMBER

LMI– CE005R1

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Corps of Engineers
20 Massachusetts Ave., N.W.
Washington, D.C. 20314-1000

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

A: Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The U.S. Army Corps of Engineers (USACE) provides engineering and construction management services for both military and civil works programs. In FY93, the cost of those programs exceeded $10 billion and their implementation required more than a 40,000-person work force. Managing this work force is an important part of USACE program execution. Those work force management processes are periodically reviewed to ensure that USACE is getting the most for its manpower dollars.

In this report, we recommend the development of a manpower information system that uses the current communication capabilities of the USACE wide-area network and meets the following key requirements: First, USACE's leaders expressed the need for a system that is easy to learn and use, easy to implement in the field, and can be used in the field as a planning and management tool. Second, the system should be able to estimate the manpower required to execute USACE's programs, support the allocation process, provide information in useful ways, track utilization information, support "what if" analyses, and draw upon various sources of data. Third, the system should provide a unified, standardized, relational data base from which consistent standard and ad hoc reports can be generated from the same essential information. Finally, USACE must gain the functional capabilities — such as decision support, executive information retrieval, and geographic information displays — that existing manpower systems lack.

14. SUBJECT TERMS

Manpower, Information System, U.S. Army Corps of Engineers, Manpower Management

15. NUMBER OF PAGES

83

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL